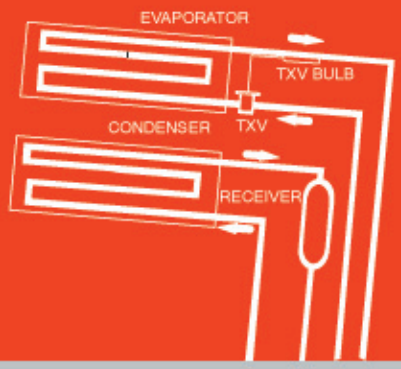
Carrier

Trailer & Rail Refrigeration



OPERATION & SERVICE

for

X SERIES

Trailer and Rail Refrigeration Units With Advance™ Microprocessor

62-10683 Rev B

Carrier
TRANSICOLD

OPERATION AND SERVICE MANUAL

NOSEMOUNT TRAILER AND RAIL REFRIGERATION UNITS

WITH ADVANCE MICROPROCESSOR

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SECTION 1

SAFETY PRECAUTIONS

1.1 SAFETY PRECAUTIONS

Your Carrier Transicold refrigeration unit has been designed with the safety of the operator in mind. During normal operation, all moving parts are fully enclosed to help prevent injury. During all pre-trip inspections, daily inspections, and problem troubleshooting, you may be exposed to moving parts. Please stay clear of all moving parts when the unit is in operation and when the unit main power switch is in the START/RUN position.

⚠ CAUTION

Under no circumstances should anyone attempt to repair the Logic or Display boards. Should a problem develop with these component, contact your nearest Carrier Transicold dealer for replacement.

⚠ CAUTION

Under no circumstances should a technician electrically probe the processor at any point, other than the connector terminals where the harness attaches. Microprocessor components operate at different voltage levels and at extremely low current levels. Improper use of voltmeters, jumper wires, continuity testers, etc. could permanently damage the processor.

⚠ CAUTION

Most electronic components are susceptible to damage caused by electrical static discharge (ESD). In certain cases, the human body can have enough static electricity to cause resultant damage to the components by touch. This is especially true of the integrated circuits found on the truck/-trailer microprocessor.

Auto-Start

Your refrigeration unit is equipped with Auto-Start in both Start-Stop and Continuous Run modes. The unit may start at any time when the START/RUN-OFF switch (SROS) is in the START/RUN position. A buzzer will sound for five seconds before the unit is started. When performing any check of the refrigeration unit (e.g., checking the belts, checking the oil), make certain that the SROS is in the OFF position.

Engine Coolant

The engine is equipped with a pressurized cooling system. Under normal operating conditions, the coolant in the engine and radiator is under high pressure and is very hot. Contact with hot coolant can cause severe burns. Do not remove the cap from a hot radiator. If the cap must be removed, do so very slowly in order to release the pressure without spray.

Refrigerants

The refrigerant contained in the refrigeration system of your unit can cause frostbite, severe burns, or blindness when in direct contact with the skin or eyes. For this reason, and because of legislation regarding the handling of refrigerants during system service, we recommend that whenever your unit requires service of the refrigeration system you contact your nearest Carrier Transicold authorized repair facility for service.

Battery

This unit is equipped with a lead-acid type battery. The battery normally vents small amounts of flammable hydrogen gas. Do not smoke when checking the battery. A battery explosion can cause serious physical harm and/or blindness.

1.2 SPECIFIC WARNING AND CAUTION STATEMENTS

To help identify the label hazards on the unit and explain the level of awareness each one carries, an explanation is given with the appropriate consequences:

DANGER – Warns against an immediate hazard which WILL result in severe personal injury or death.

WARNING – Warns against hazards or unsafe conditions which COULD result in severe personal injury or death.

CAUTION – Warns against potential hazard or unsafe practice which could result in minor personal injury, or product or property damage.

The statements listed below are specifically applicable to this refrigeration unit and appear elsewhere in this manual. These recommended precautions must be understood and applied during operation and maintenance of the equipment covered herein.

⚠ WARNING

Beware of V-belts and belt driven components as the unit may start automatically. Before servicing unit, make sure the START/RUN-OFF switch is in the OFF position or the unit is in Maintenance mode. Also disconnect the negative battery cable.

⚠ WARNING

UNITS EQUIPPED WITH STAR-TRAK TWO WAY COMMUNICATION CAPABILITIES MAY HAVE THE ABILITY TO BE STARTED OR TURNED OFF REMOTELY REGARDLESS OF THE SETTING OF THE START/RUN-OFF SWITCH.

The unit is controlled locally and there can be no two-way communication when the Mode switch on the Remote Monitoring Control Box is in MAINTENANCE MODE. Therefore, when performing maintenance on the unit, place the Mode switch in MAINTENANCE MODE. After the unit is serviced, return the Mode switch to REMOTE ON. (Refer to Section 3.19.3 for more detailed information on two-way communication.)

⚠ WARNING

Under no circumstances should ether or any other starting aids be used to start engine.

⚠ WARNING

The +5.0 VDC (terminal B) is common between the Compressor Discharge Pressure Transducer, the Compressor Suction Pressure Transducer, and the RPM sensor. If this circuit is shorted to ground (due to one of the mentioned components being defective, or a worn wire) the MessageCenter will show:

- **Suction Pressure: -29.9inHg (-1 Bar)**
- **Discharge Pressure: 0 Bar/PSIG**
- **Engine RPM: 0.**

⚠ WARNING

Keep hands and arms away from unit when operating without belt guard in place. Never release a unit for service without the belt guard securely tightened in place

⚠ WARNING

Do not start unit without installing the evaporator panels as unit damage or body harm may result.

⚠ WARNING

Do not use a nitrogen cylinder without a pressure regulator. Cylinder pressure is approximately 159.9 Bars (2350 PSIG). Do not use oxygen in or near a refrigerant system as an explosion may occur. (See Figure 8-26)

⚠ WARNING

The Compressor Discharge Pressure Transducer does not have a Schrader valve in the connecting fitting. Any discharge pressure remaining in the compressor will be released when removing the CDP.

⚠ WARNING

Carrier Transicold does not recommend allowing the compressor to pull less than 0 Bar/PSIG at any time.

⚠ CAUTION

Observe proper polarity when installing battery, negative battery terminal must be grounded. Reverse polarity will destroy the rectifier diodes in alternator. As a precautionary measure, disconnect positive battery terminal when charging battery in unit. Connecting charger in reverse will destroy the rectifier diodes in alternator.

⚠ CAUTION

Use only ethylene glycol anti-freeze (with inhibitors) in system as glycol by itself will damage the cooling system. Always add pre-mixed 50/50 anti-freeze and water to radiator/engine. Never exceed more than a 60% concentration of anti-freeze. Use a low silicate anti-freeze meeting GM specifications GM 6038M for standard life coolant or use Texaco Havoline extended life coolant or any other extended life coolant which is Dexcool approved and has 5/150 (5 years/150,000 miles) on the label.

⚠ CAUTION

When changing oil filters, the new filters should be primed (partially filled) with clean oil if possible. If the filters are not primed, the engine may operate for a period with no oil supplied to the bearings.

⚠ CAUTION

Service Mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating.

⚠ CAUTION

The display and MessageCenter may behave differently during the software loading process, depending on the version of software currently in the controller. DO NOT INTERRUPT THE SOFTWARE INSTALLATION PROCESS ONCE IT HAS STARTED.

⚠ CAUTION

It is important that communications between the Micro and the computer are not disturbed during the software loading process. If using a laptop computer, turn all energy saving features off. Turn off any screen saver, or any hard drive time out settings.

⚠ CAUTION

Be certain that the clock you are using is accurate, and is showing the correct time. Also, some customers are located in different time zones from where the repair is being made. If you know what time zone they use, enter that time. If you don't, then enter the current time where you are located.

⚠ CAUTION

Unit uses R404A and POE oil. The use of inert gas brazing procedures is mandatory for all Carrier Transicold refrigeration units; otherwise compressor failure will occur. For more information Refer to Technical Procedure 98-50553-00 Inert Gas Brazing

⚠ CAUTION

Do not get anti-seize oil/compound onto clutch contact surfaces. Thoroughly clean off oil/compound with contact or brake cleaner if this occurs.

⚠ CAUTION

Only a refrigerant drum containing R404a should be connected to units covered by this manual in order to pressurize the system. Any other gas or vapor will contaminate the system, which will require additional purging and evacuation of the high side (discharge) of the system.

⚠ CAUTION

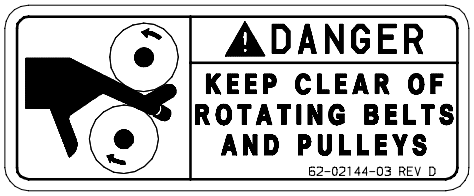
Do not vapor charge R404a systems. Only liquid charging through the receiver outlet (King) valve is acceptable.

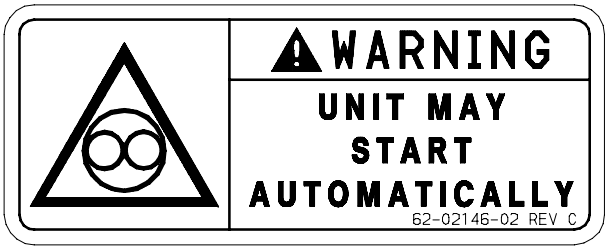
⚠ CAUTION

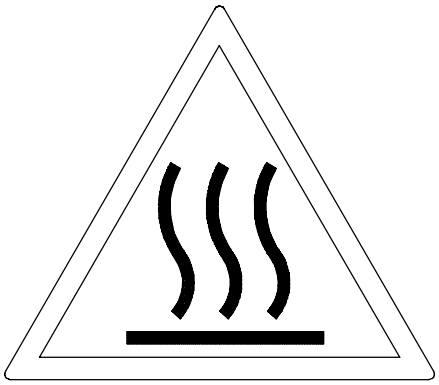
Do not over tighten or damage the enclosing tube assembly. Torque to 17-ft pounds (2.4 Mkg). Also make sure all parts are placed on the enclosing tube in proper sequence to avoid premature coil burnout.

⚠ CAUTION

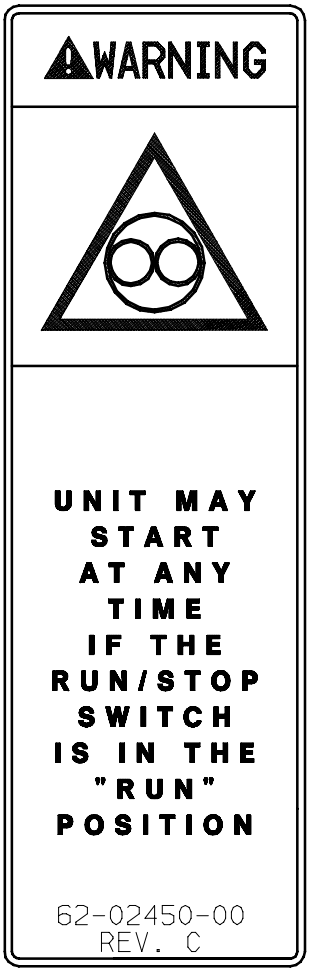
When adding oil to the compressor, extreme care must be taken to ensure the hose is immersed in the oil at all times. Otherwise air and moisture will be drawn into the compressor.

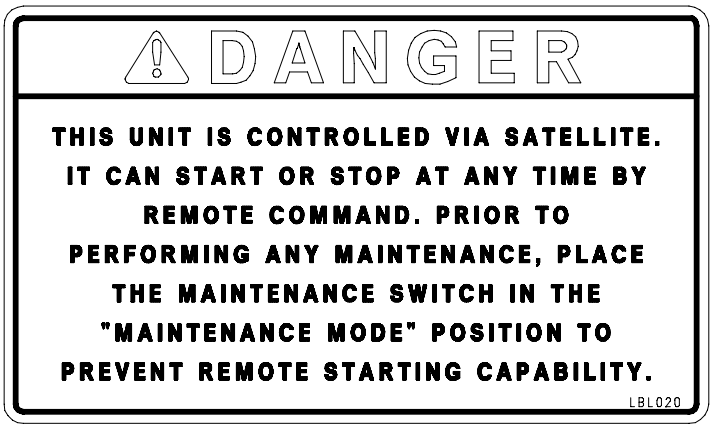




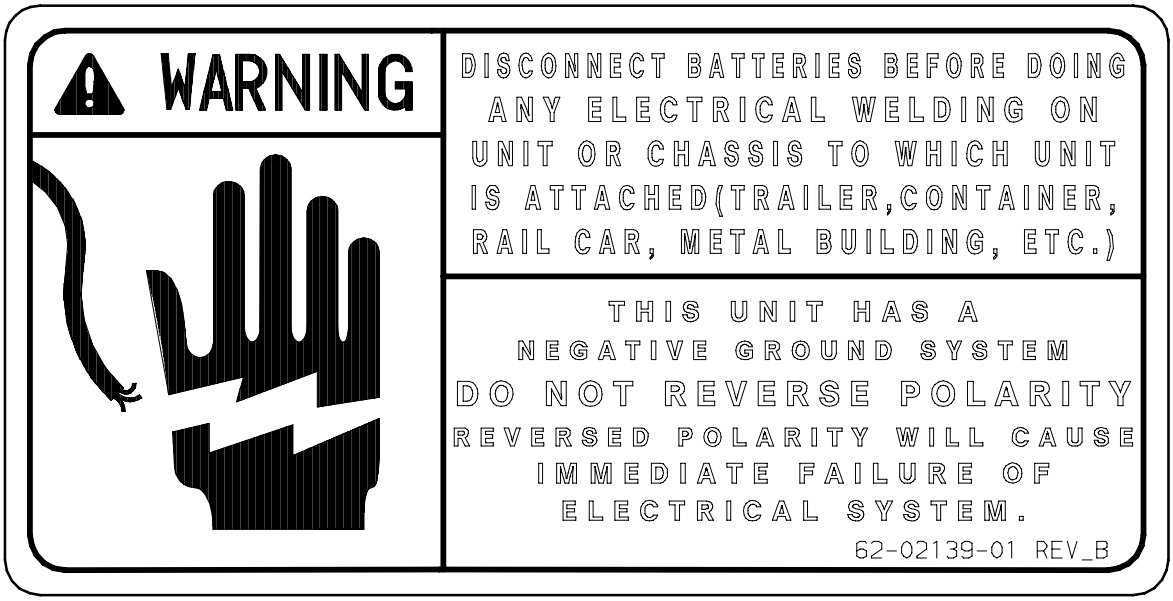


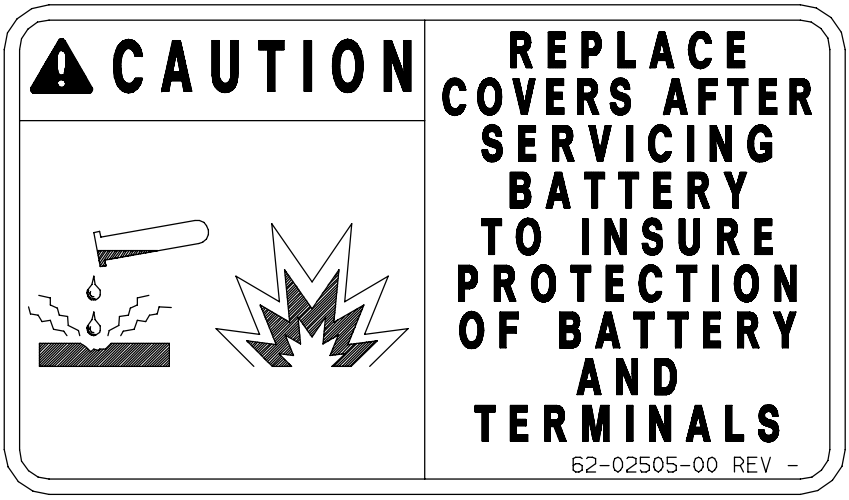
62-03958-00 Heat Warning

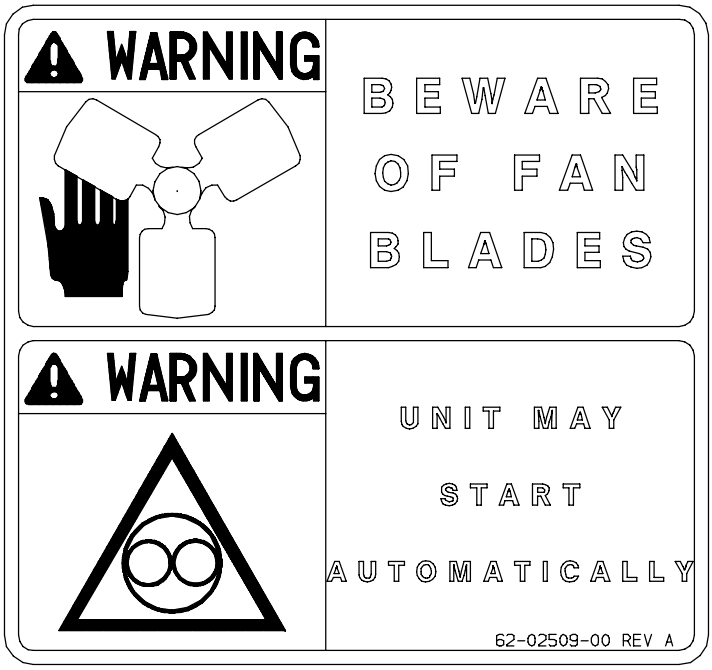


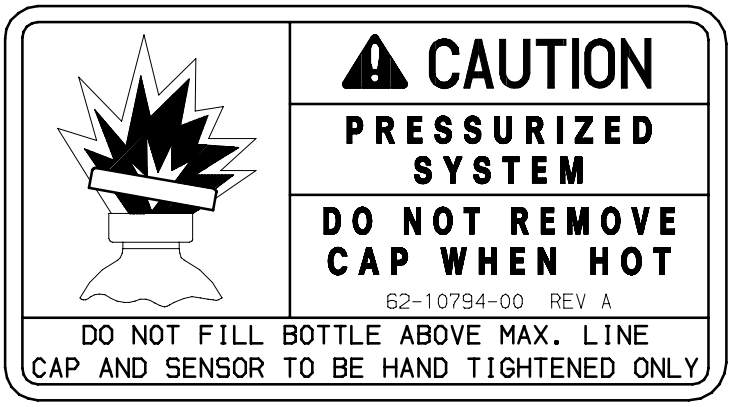

DANGER
THIS UNIT IS CONTROLLED VIA SATELLITE.
IT CAN START OR STOP AT ANY TIME BY
REMOTE COMMAND. PRIOR TO
PERFORMING ANY MAINTENANCE, PLACE
THE MAINTENANCE SWITCH IN THE
"MAINTENANCE MODE" POSITION TO
PREVENT REMOTE STARTING CAPABILITY.
LBL020

ONLY USED ON UNITS WITH TWO-WAY COMMUNICATION CAPABILITIES

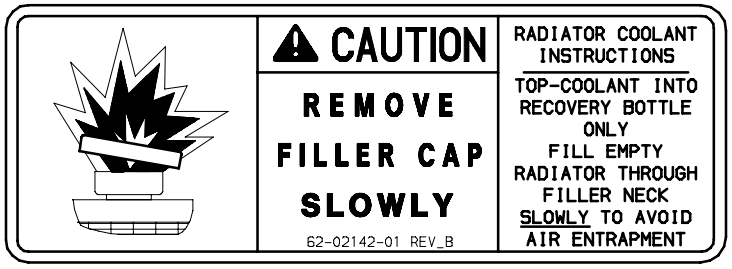

WARNING
DISCONNECT BATTERIES BEFORE DOING ANY ELECTRICAL WELDING ON UNIT OR CHASSIS TO WHICH UNIT IS ATTACHED(TRAILER,CONTAINER, RAIL CAR, METAL BUILDING, ETC.)
THIS UNIT HAS A NEGATIVE GROUND SYSTEM
DO NOT REVERSE POLARITY
REVERSED POLARITY WILL CAUSE IMMEDIATE FAILURE OF ELECTRICAL SYSTEM.
62-02139-01 REV_B


CAUTION
REPLACE COVERS AFTER SERVICING BATTERY TO INSURE PROTECTION OF BATTERY AND TERMINALS
62-02505-00 REV -


WARNING
BEWARE
OF FAN
BLADES
WARNING
UNIT MAY
START
AUTOMATICALLY
62-02509-00 REV A


CAUTION
PRESSURIZED
SYSTEM
DO NOT REMOVE
CAP WHEN HOT
62-10794-00 REV A
DO NOT FILL BOTTLE ABOVE MAX. LINE
CAP AND SENSOR TO BE HAND TIGHTENED ONLY

OR


CAUTION
REMOVE
FILLER CAP
SLOWLY
62-02142-01 REV_B
RADIATOR COOLANT
INSTRUCTIONS
TOP-COOLANT INTO
RECOVERY BOTTLE
ONLY
FILL EMPTY
RADIATOR THROUGH
FILLER NECK
SLOWLY TO AVOID
AIR ENTRAPMENT

SECTION 2

UNIT DESCRIPTION

2.1 INTRODUCTION

⚠ WARNING

Beware of V-belts and belt driven components as the unit may start automatically. Before servicing unit, make sure the START/RUN-OFF switch is in the OFF position or the unit is in Maintenance mode. Also disconnect the negative battery cable.

This manual contains Operating Data, Electrical Data and Service Instructions for the refrigeration units listed in Table 2-1.

Additional support manuals are listed in Table 2-2.

The model/serial number plate is located inside the unit on the frame as shown in Figure 2-3.

2.2 GENERAL DESCRIPTION

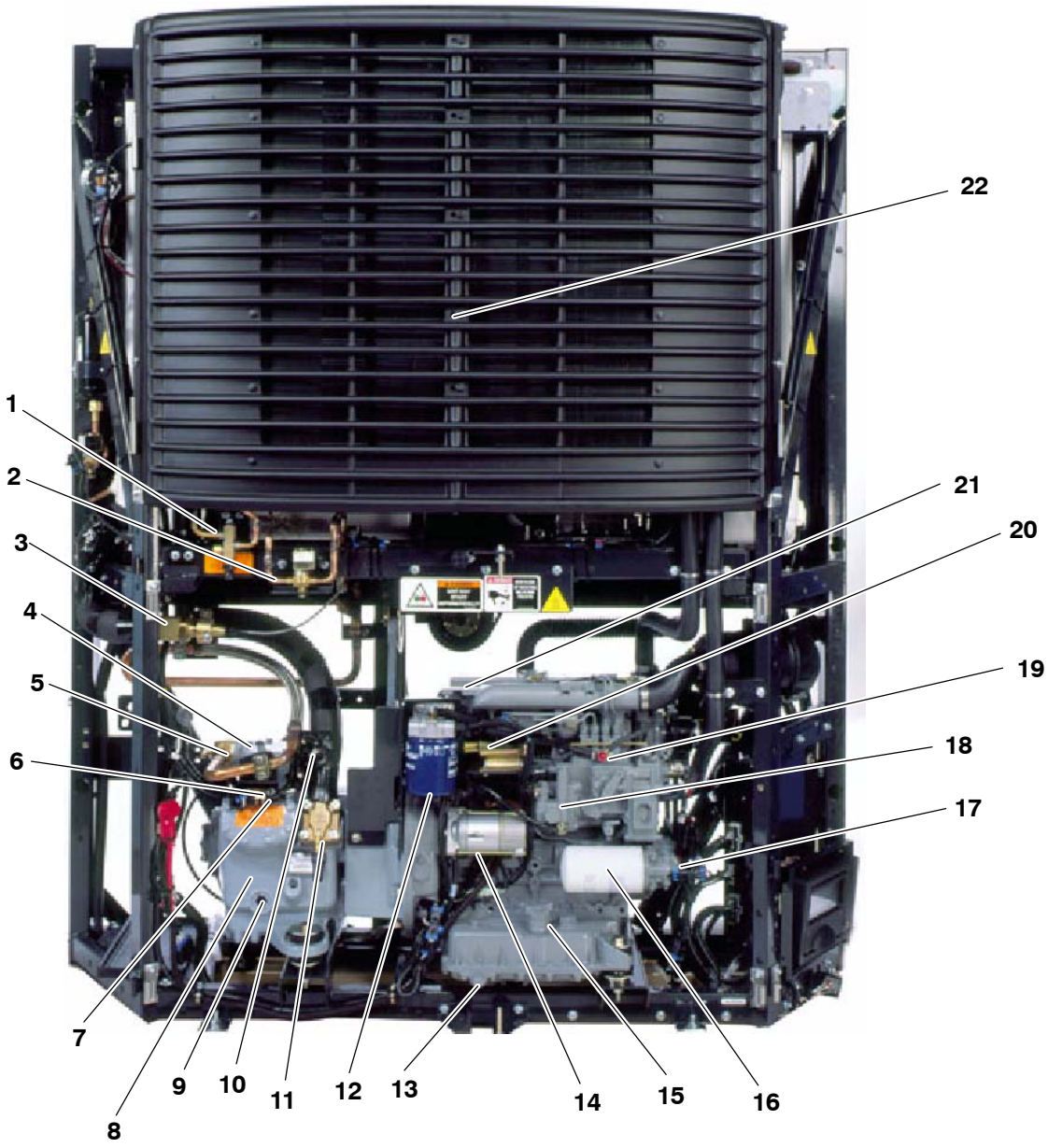
The refrigeration units described in this manual are one-piece, self-contained, fully charged, pre-wired, refrigeration/heating nosemount diesel powered units for use on insulated trailers or rail cars to maintain cargo temperatures within very close limits.

Table 2-1. Model Chart

Advance Models	R-404A		Compressor	Engine	Engine Speed	
	KG	LB			High	Low
Ultra XTC NDL-93NN	9.1	20	05G 41cfm	CT4-134-DI	1700	1350
Ultra XTC Rail Edition NDL-93NR						
Ultra XTC with Tier 2 Engine NDL-93VN						
Ultima XTC NDL-93PN	9.5	21			2200	1475
Ultima XTC Rail Edition NDX-93PR						
Ultima XTC with Tier 2 Engine NDL-93RN						
X2 2100A and R NDL93S				V2203-DI ESC	1700	
X2 2500A and R NDL93U					2200	

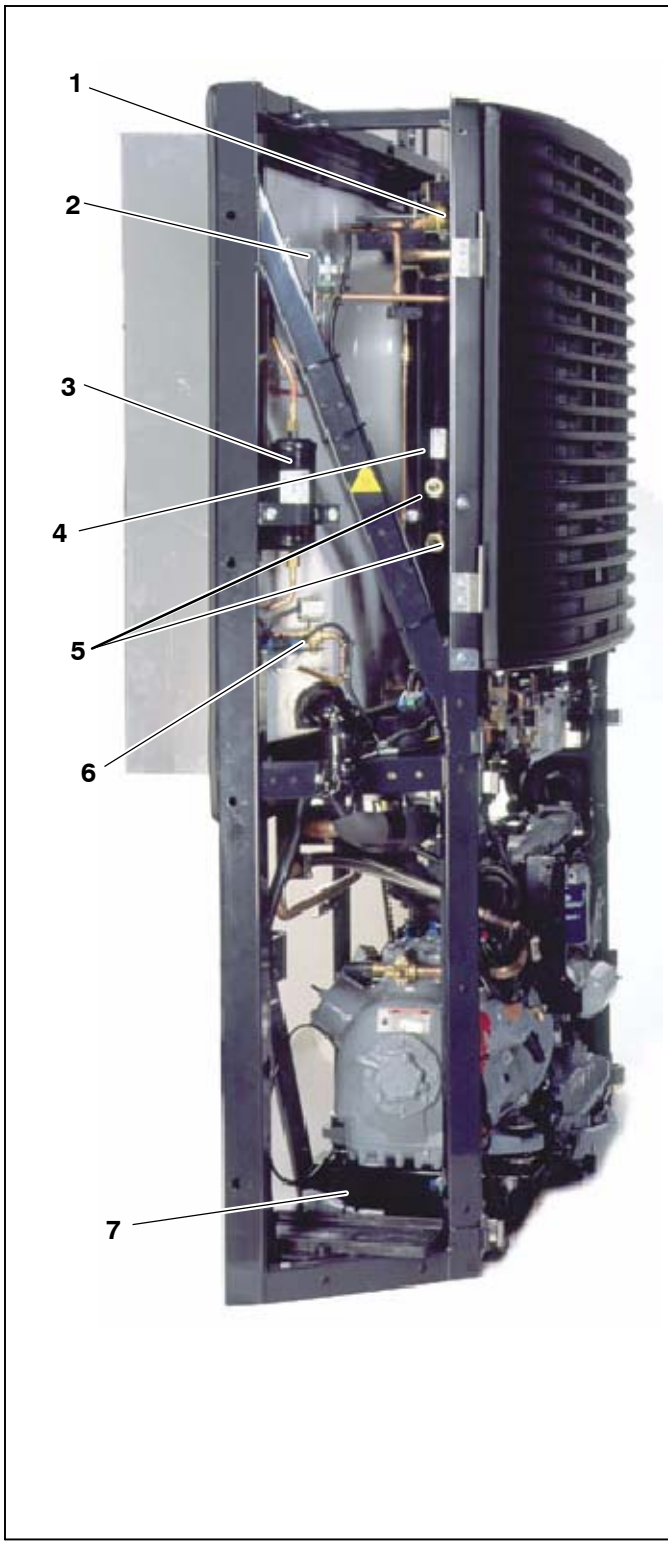
Table 2-2. Additional Support Manuals

Manual Number	Equipment Covered	Type of Manual
62-10671	Ultra/Ultima XTC	Parts List
62-11171	X2 2100/2500 A AND R	Parts List
62-10646	Units With Advance Microprocessor	Operator's Manual
62-10682	Units With Advance Microprocessor	Easy To Run
62-10295	Engine V2203-DI	Parts List
62-10863	Engine (Tier 2)	Parts List
62-11168	Engine (Electronic Speed Control)	Parts List
62-10301	Engine V2203-DI	Workshop
62-10865	Engine (Tier 2)	Workshop
62-11167	Engine (Electronic Speed Control)	Workshop
62-10299	Compressor	Parts List
62-11053	Compressor (05G TWINPORT))	Parts List
62-02756	Compressor	Service
62-11052	Compressor (05G TWINPORT)	Service



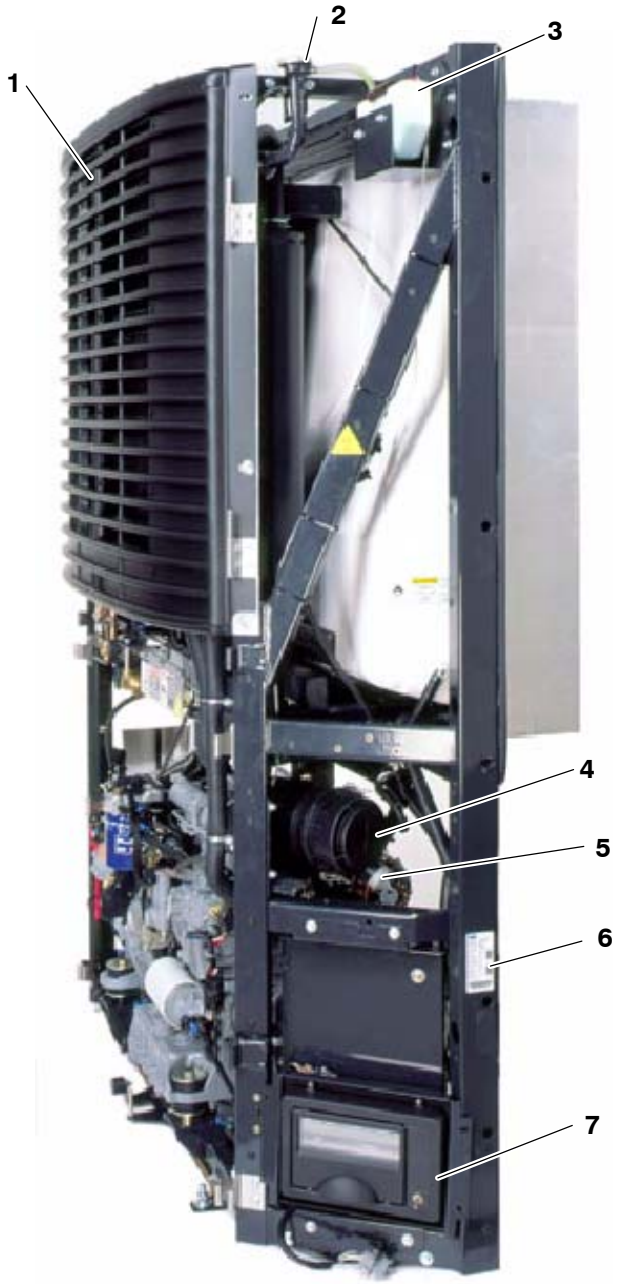
1. King Valve
2. Hot Gas Solenoid Valve (SV4)
3. Suction Modulation Valve (CSMV)
4. High Pressure Cutout Switch (HPS)
5. Discharge Service Valve
6. Unloader Solenoid Valve
7. Compressor Discharge Transducer (CDT)
8. Compressor - 05G
9. Compressor Sight Glass
10. Suction Pressure Transducer (CSP)
11. Suction Service Valve
12. Fuel Filter
13. Engine Oil Drain
14. Starter Motor
15. Lube Oil Fill and Dipstick
16. Lube Oil Filter
17. Oil Pressure Switch (OP)
18. Mechanical Fuel Pump
19. Fuel Bleed Valve
20. Speed Control Solenoid (SCS)
21. Water Temperature Sensor (WTS)
22. Ambient Temperature Sensor (ATS)

Figure 2-1. Front View Of Unit With Non ESC Engine



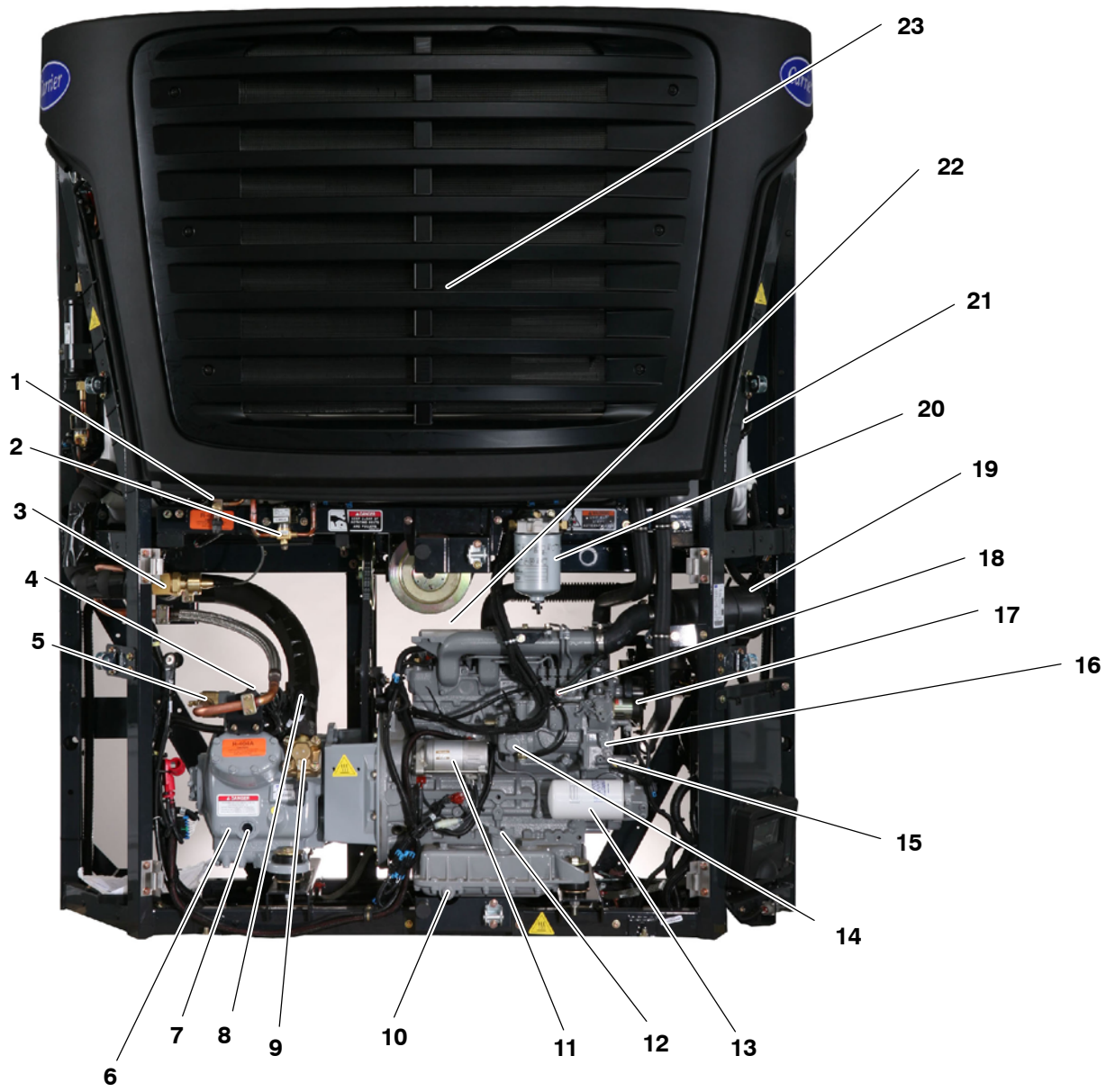
1. Condenser Pressure Control Solenoid Valve (SV1)
2. Defrost Air Switch
3. Filter-Drier
4. Receiver
5. Receiver Sight Glass
6. Liquid Line Solenoid Valve (SV2)
7. Battery Location

Figure 2-2. Curbside (Non ESC Engine)



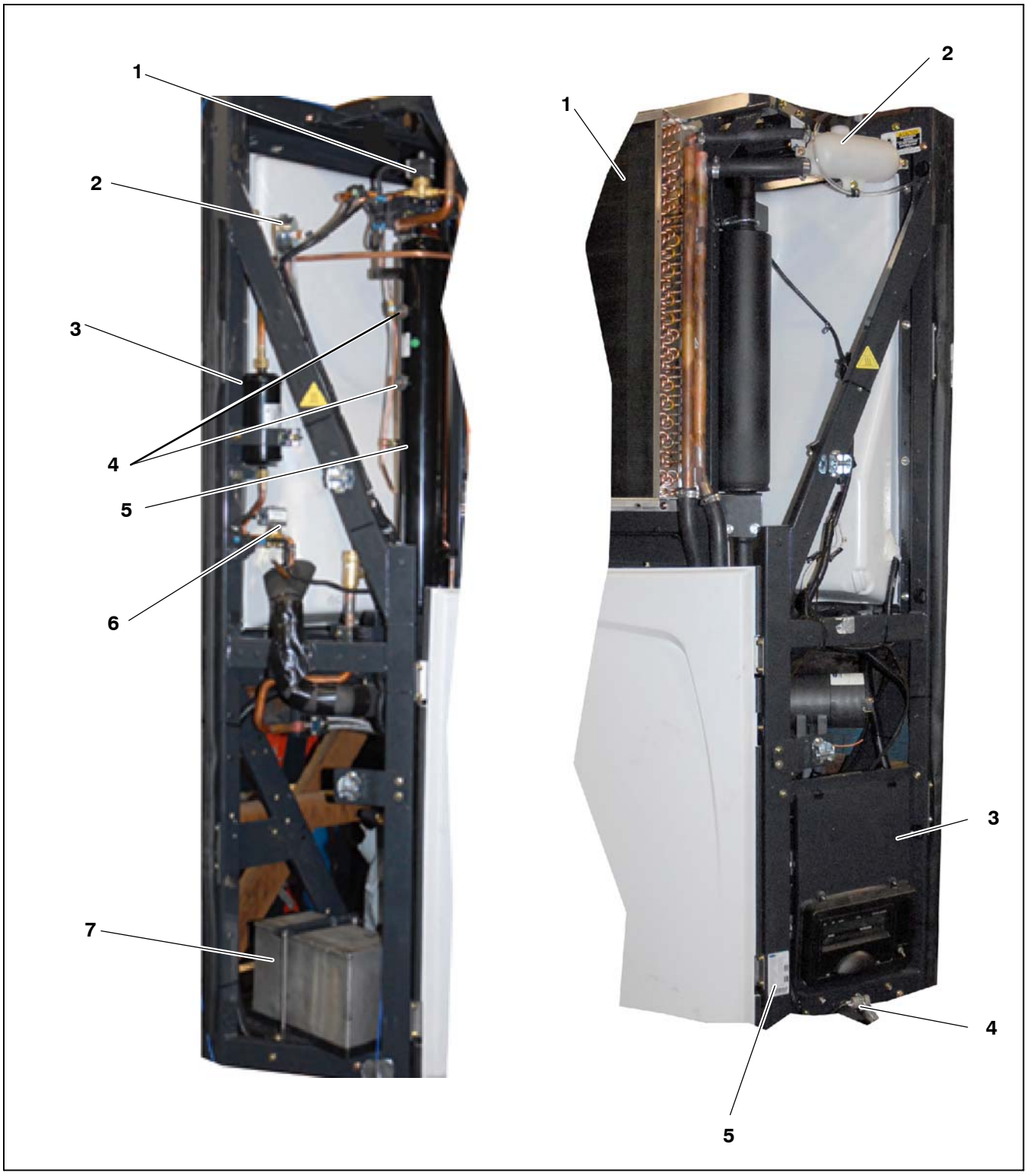
1. Condenser/Radiator
2. Radiator Fill Neck
3. Radiator Overflow Reservoir
4. Engine Air Cleaner
5. Alternator – See Figure 2-11
6. Model/Serial No. Location
7. Control Box – See Figure 2-8

Figure 2-3. Roadside (Non ESC Engine)



1. King Valve
2. Hot Gas Solenoid Valve (SV4)
3. Suction Modulation Valve (CSMV)
4. High Pressure Cutout Switch (HPS), Compressor Discharge Transducer (CDT) and Unloader Solenoid Valve
5. Discharge Service Valve
6. Compressor – 05G
7. Compressor Sight Glass
8. Suction Pressure Transducer (CSP)
9. Suction Service Valve
10. Engine Oil Drain
11. Starter Motor
12. Lube Oil Fill and Dipstick
13. Lube Oil Filter
14. Mechanical Fuel Pump
15. Engine Oil Pressure Switch (ENOPS)
16. Engine Speed Sensor (ENSSN)
17. Fuel and Speed Actuator (FSA) and Alternator
18. Fuel Bleed Valve
19. Engine Air Cleaner
20. Fuel Filter
21. Engine Speed Control Unit
22. Ambient Temperature Sensor (AAT)
23 Water Temperature Sensor (WTS) On Back of Engine

Figure 2-4. Front View Of Unit With Electronic Speed Control (Electronic Speed Control)

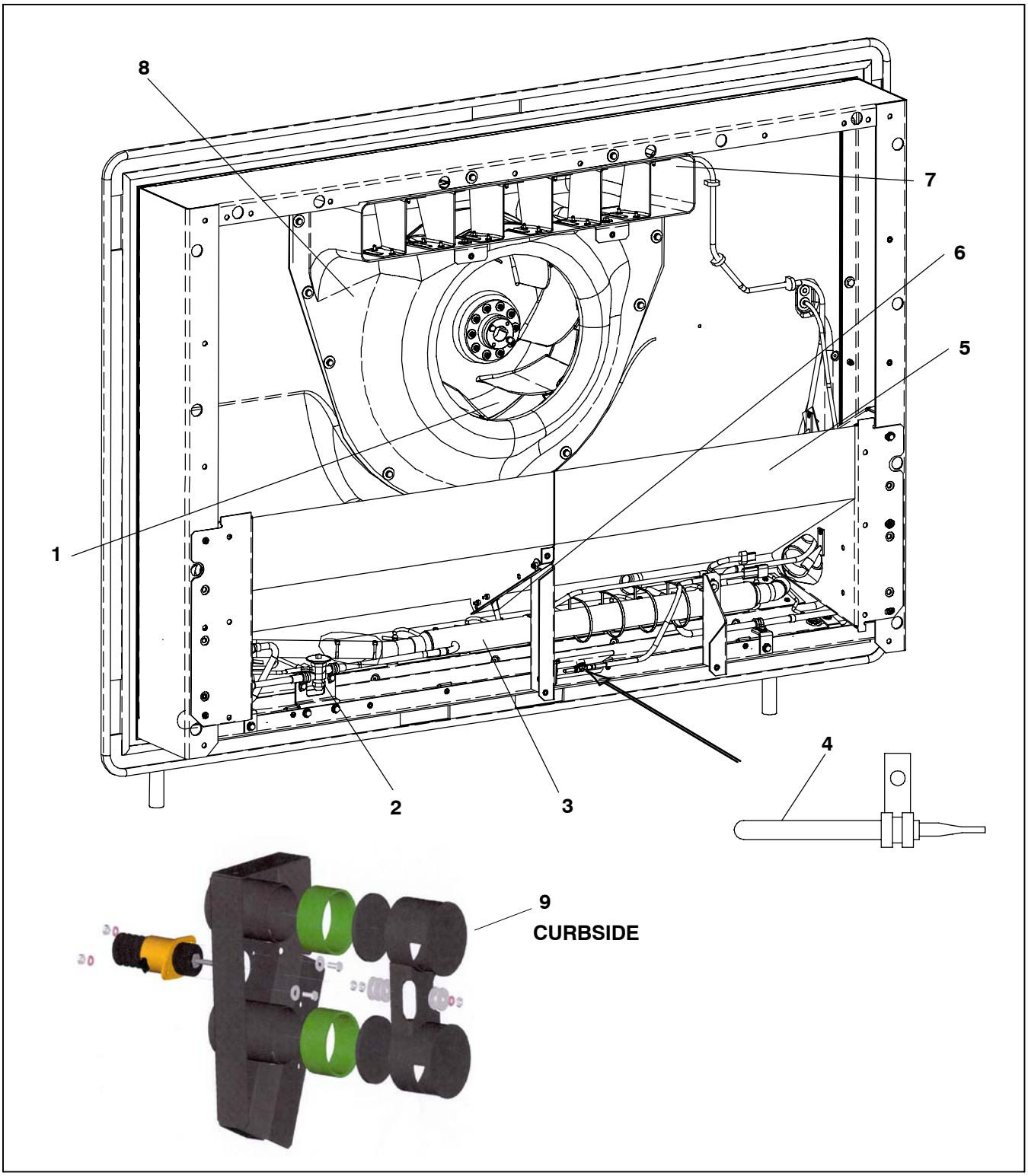


1. Condenser Pressure Control Solenoid Valve (SV1)
2. Defrost Air Switch
3. Filter-Drier
4. Receiver Sight Glass
5. Receiver
6. Liquid Line Solenoid Valve (SV2)
7. Battery Location

Figure 2-5. Curbside (Electronic Speed Control)

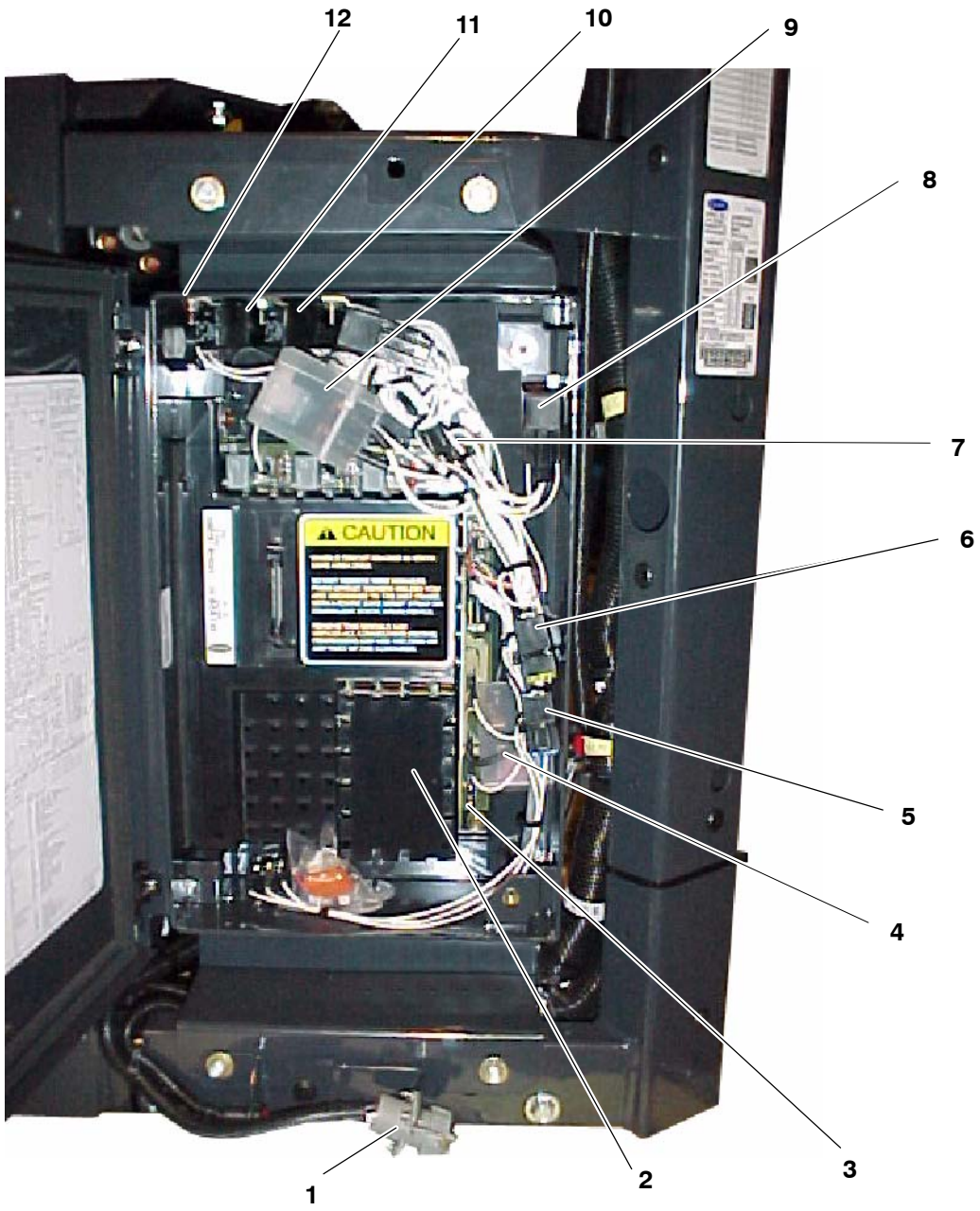
1. Condenser/Radiator
2. Pressurized Coolant System
3. Control Box – See Figure 2-8
4. Serial Port / Download Plug (SLP)
5. Model/Serial No. Location

Figure 2-6. Roadside (Electronic Speed Control)



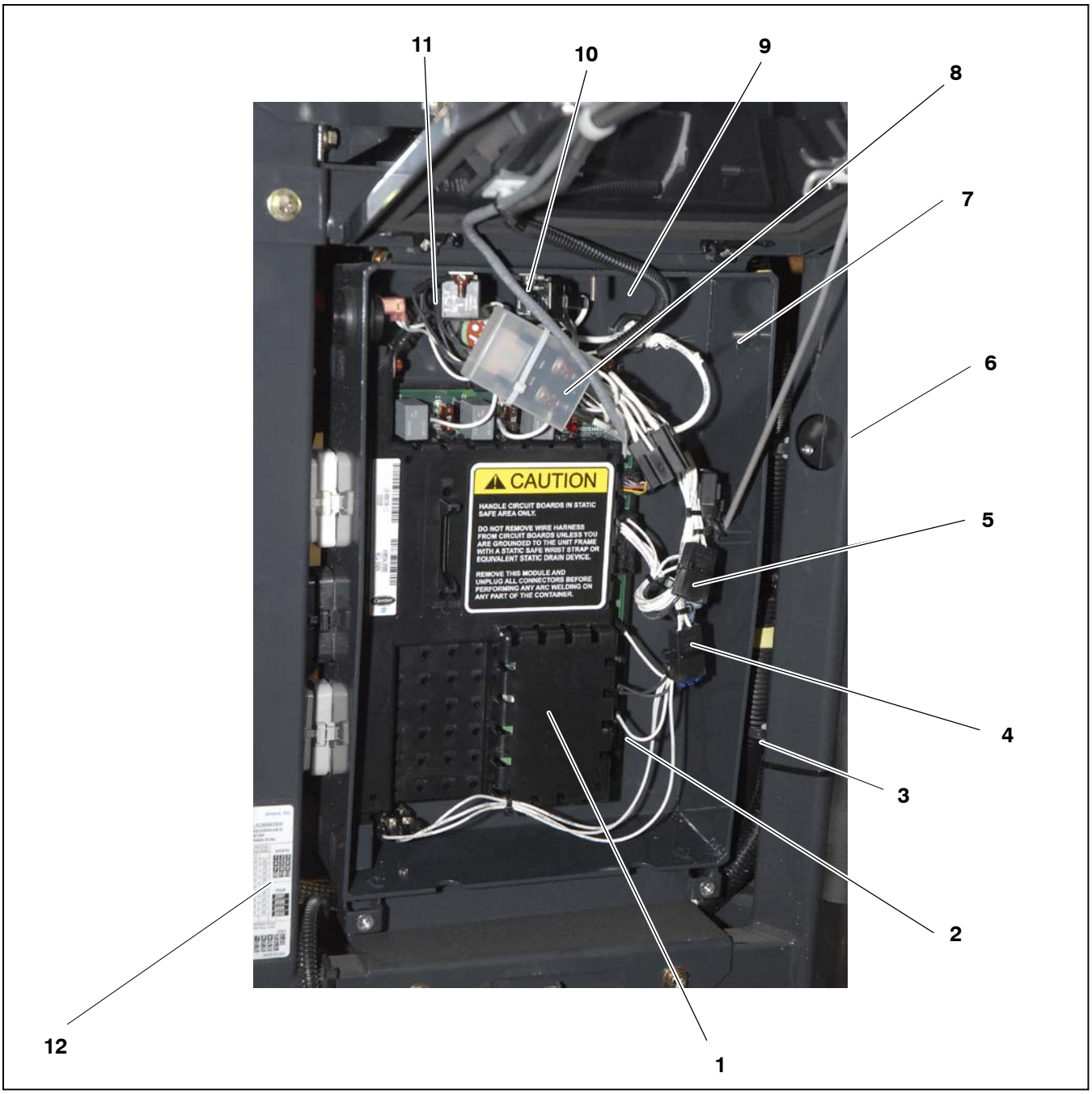
1. Evaporator Fan
2. Expansion Valve
3. Heat Exchanger
4. Return Air Thermistor (RAT)
5. Evaporator Coil
6. Defrost Termination Thermostat (DTT2)
7. Supply Air Thermistor (SAT)
8. Nozzle Cover
9. AutoFresh™ Air Exchange (See Sections 2.4.3 and 3.19.4

Figure 2-7. Evaporator Section – Panels and Grille Removed



1. Serial Port / Download Plug (SLP)
2. Control Module (Microprocessor) Refer to Section 2.5.3
3. Fuse (F1) 7.5 Amp
4 Fuse (F10) 40 Amp – Optional Auto Fresh Air Exchange
5. Fuse (F7) 5 Amp
6. Fuse (F6) 15 Amp (Fuel Pump)
7. Fuse (F8) 20 Amp (Optional Fuel Heater)
8. AutoFresh Relay (AFAR)
9. Fuse (F5) 80 Amp
10. Fuel Heater Relay (FHR)
11. Starter Solenoid Relay (SSR)
12. Glow Plug Relay (GPR)

Figure 2-8. Control Box (Short Box)


11
10
9
8
7
6
5
4
3
2
1
12
CAUTION
HANDLE CIRCUIT BOARDS IN STATIC SAFE AREA ONLY.
DO NOT REMOVE WIRE HARNESS FROM CIRCUIT BOARDS UNLESS YOU ARE GROUNDED TO THE UNIT FRAME WITH A STATIC SAFE WRIST STRAP OR EQUIVALENT STATIC DRAIN DEVICE.
REMOVE THIS MODULE AND UNPLUG ALL CONNECTORS BEFORE PERFORMING ANY ARC WELDING ON ANY PART OF THE CONTAINER.

1. Control Module (Microprocessor) Refer to Section 2.5.3
2. Fuse (F1) 7.5 Amp – Located next to control module
3 Fuse (F10) 40 Amp – Optional Auto Fresh Air Exchange – Location Only
4. Fuse (F6) 15 Amp
5. Fuse (F8) 20 Amp (Optional Fuel Heater)
6. Fuse (F7) 5 Amp
7. AutoFresh Relay (AFAR) – Location Only
8. Fuse (F5) 80 Amp
9. Fuel Heater Relay (FHR) – Location Only
10. Starter Solenoid Relay (SSR)
11. Glow Plug Relay (GPR)
12. Glow Crank Switch (GCS) – If equipped

Figure 2-9. Control Box (Redesigned Tall Box)

2.3 CONDENSING SECTION

The condensing section consists of an engine-compressor drive package, condenser fan, condenser/radiator coil, refrigerant controls, piping, wiring, defrost air switch, and associated components.

The drive equipment includes the engine, clutch, air cleaner, muffler, coolant overflow bottle, and drive belts.

Refrigeration components mounted in the condensing section include the compressor, defrost air switch, suction modulation valve, filter drier, and receiver.

2.3.1 Engine

The diesel engine drives the compressor directly through a nylon drive gear and adapter. The adapter also includes a V-belt sheave which drives the gearbox. The condenser/evaporator fan shaft is driven with a V-belt from the gearbox. The water pump V-belt drives the alternator.

The engine (refer to Section 2.6) gives excellent fuel economy and has easy starting characteristics. It is equipped with spin-on lube oil and fuel oil filters for easier filter changes.

Engine Transducers and Sensors:

a. Engine RPM Sensor (ENRPM) (Non ESC engines only)

Provides micro with engine RPM information to be displayed and recorded in the DataRecorder. It is located on the rear of the engine in the flywheel housing.

b. Engine Oil Pressure Switch (ENOPS)

This normally open switch allows the engine to operate when oil pressure is above 15 $\pm$ 3 PSIG (1.02 $\pm$ 0.2 Bars). The switch will open and automatically stop the engine 5 seconds after pressure drops below 12.3 $\pm$ 3 PSIG (0.84 Bar). There is a 15-second delay after the engine starts to allow the oil pressure to build up before the microprocessor looks at the input from this switch. The switch is located on the front of the engine below the fuel solenoid.

c. Engine Oil Level Switch (ENOLS) (Optional)

ENOLS sets off alarm when oil level is low. Located on the oil pan next to the oil fill.

d. Engine Coolant Temperature Sensor (ENCT)

Provides micro with engine coolant temperature information to be displayed and recorded in the DataRecorder . The sensor is located on the starter side of the engine near the #4 Injector.

e. Engine Coolant Level Sensor (ENCLS) (Optional)

Sets off alarm when coolant level is low. Located in the coolant bottle.

f. Engine Speed Control Unit (ENSCU) (ESC only) (See Figure 2-10)

The ENSCU is mounted on the roadside frame behind the upper door. It provides the RPM signal to the microprocessor. The unit has an alarm LED incorporated within it, which is used to diagnose failures within the ESC system. See Section 9.4 for information on diagnosing failures.

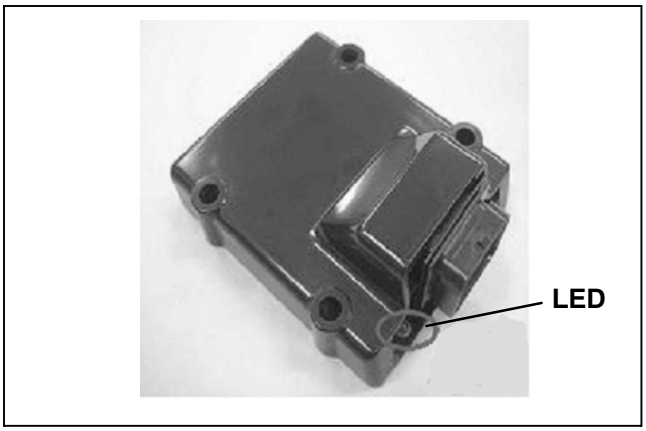


Figure 2-10. Frame Mounted Engine Speed Control Unit (ENSCU)

g. Fuel and Speed Actuator (FSA) (ESC only)

The FSA combines the fuel shutoff solenoid and speed control solenoid into one component. Engine speed is controlled by varying rod position.

h. Engine Speed Sensor (ENSSN) (ESC only)

The ENSSN provides the RPM signal to the ENSCU for speed control. It is located on the front of the engine in the gear case cover.

2.3.2 Alternator/Regulator

Electrical power for the control system and for charging the battery is provided by the 12 VDC alternator.

a. Alternator Operation

⚠ CAUTION

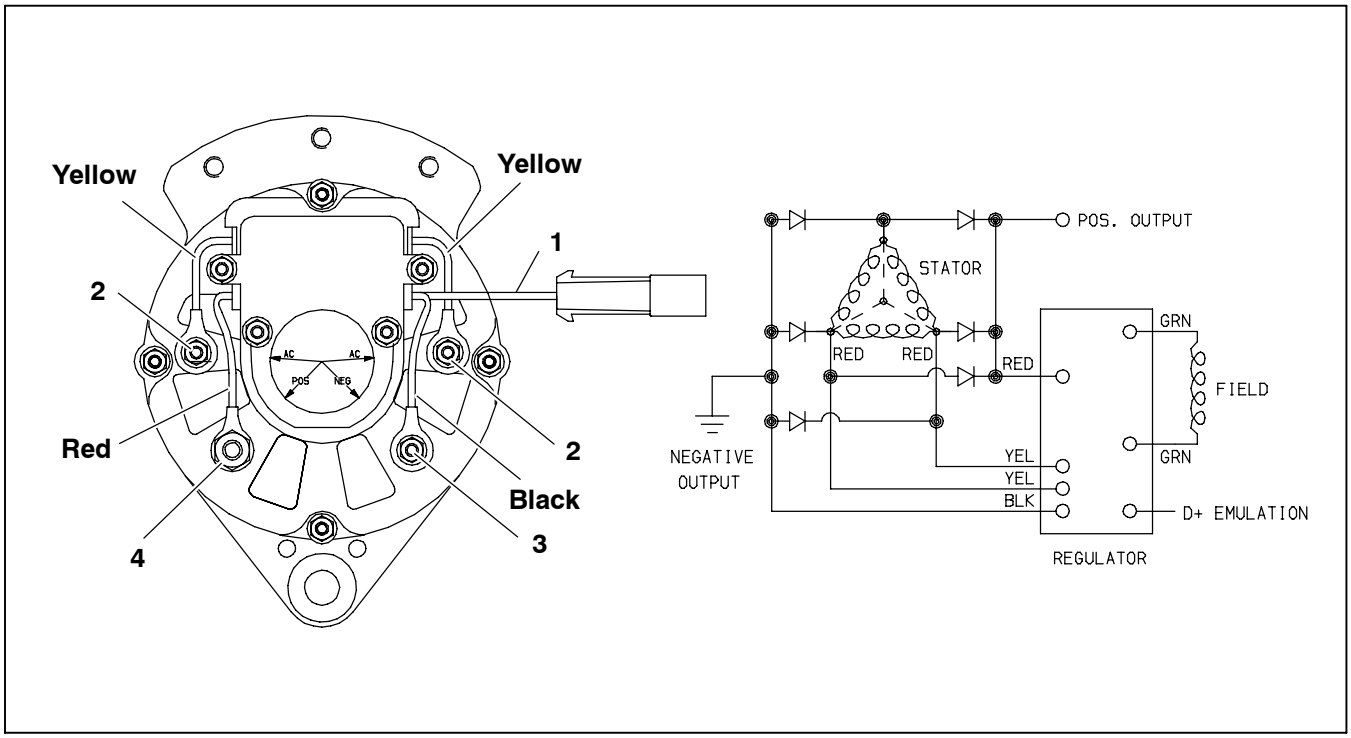
Observe proper polarity when installing battery. Negative battery terminal must be grounded. Reverse polarity will destroy the rectifier diodes in alternator. As a precautionary measure, disconnect positive battery terminal when charging battery in unit. Connecting charger in reverse will destroy the rectifier diodes in alternator.

The alternator converts mechanical and magnetic energy to alternating current (AC) and voltage, by the rotation of an electromagnetic field (rotor) inside a three-phase stator assembly. The alternating current and voltage is changed to direct current and voltage by passing AC energy through a three-phase, full-wave rectifier system. Six silicon rectifier diodes are used.

The regulator is an electronic switching device. It senses the system voltage level and switches the voltage applied to the field in order to maintain proper system voltage.

b. Integral Voltage Regulator Operation (12 VDC)

The regulator is an all-electronic, transistorized device. No mechanical contacts or relays are used to perform the voltage regulation of the alternator system. The electronic circuitry should never require adjustment and the solid state active elements used have proved reliable enough to warrant a sealed unit. The system is temperature compensated to permit the ideal charging rate at all temperatures.



1. D+ Emulation (Orange) – Not Used on Advance
2. #10-24 AC Terminal
3. #10-24 Ground Screw
4. 1/4-20 Positive Output Cable

Figure 2-11. Alternator and Regulator

2.3.3 Compressor

The compressor assembly includes the refrigerant compressor, suction and discharge service valves, high pressure switch, and the suction pressure transducer. The compressor withdraws refrigerant gas from the evaporator and delivers it to the condenser at an increased pressure. The pressure is such that refrigerant heat can be absorbed by the surrounding air at ordinary temperatures.

2.3.4 Compressor Unloaders

The refrigeration compressor used is a 41 cfm model 05G, equipped with unloaders as standard equipment. Unloaders are used as a compressor capacity control to unload the compressor during periods of reduced loads. This provides closer temperature control, reduces potential for top freezing and reduces power required to operate the compressor; thus reducing fuel consumption.

a. Major Working Parts

- Solenoid and valve system
- Spring loaded piston type bypass control valve
- Spring loaded discharge check valve

b. Unloaded Operation

Pressure from the discharge manifold (Figure 2-12, item 15) passes through the strainer (9) and bleed orifice (8) to the back of the piston bypass valve (7). Unless bled away, this pressure would tend to close the piston (6) against the piston spring (5) pressure.

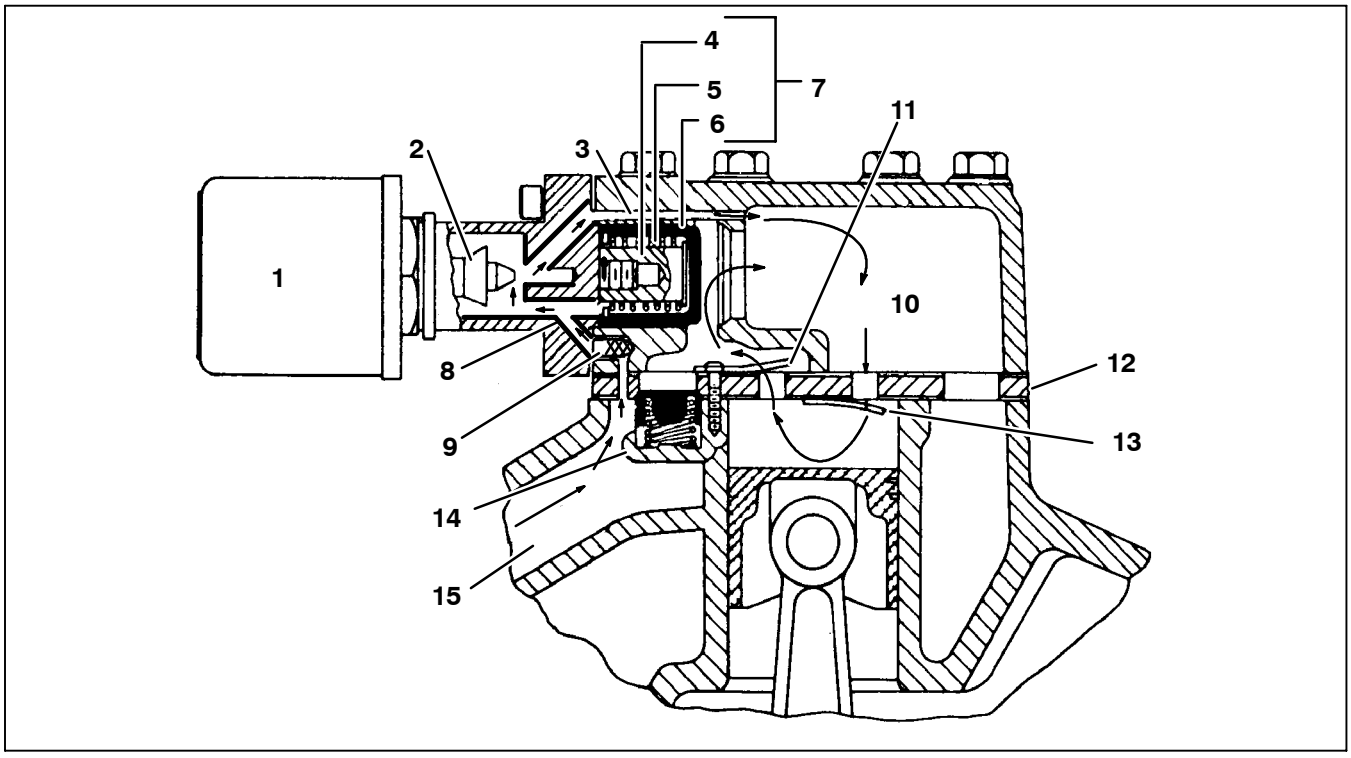
With the solenoid valve (1) *energized*, the solenoid valve stem (2) will *open* the gas bypass port (3).

Refrigerant pressure will be bled to the suction manifold (10) through the opened gas bypass port. A reduction in pressure on the piston bypass valve will take place because the rate of bleed through the gas bypass port is greater than the rate of bleed through the *bleed orifice* (8).

When the pressure behind the piston has been reduced sufficiently, the valve spring will force the piston bypass valve *back*, *opening* the gas bypass from the discharge manifold to the suction manifold.

Discharge pressure in the discharge manifold will close the discharge piston check valve assembly (14) isolating the compressor discharge manifold from the individual cylinder bank manifold.

The *unloaded* cylinder bank will continue to operate *fully unloaded* until the solenoid valve control device is *de-energized* and the gas bypass port is closed.



1. Solenoid Valve
2. Valve Stem
3. Gas Bypass Port
4. Spring Guide
5. Spring
6. Piston
7. Piston Bypass Valve
8. Bleed Orifice
9. Strainer
10. Suction Manifold
11. Cylinder Discharge Valve
12. Valve Plate
13. Cylinder Suction Valve
14. Discharge Piston Check Valve Assembly
15. Discharge Manifold

Figure 2-12. Compressor Cylinder Head Unloaded

c. Loaded Operation

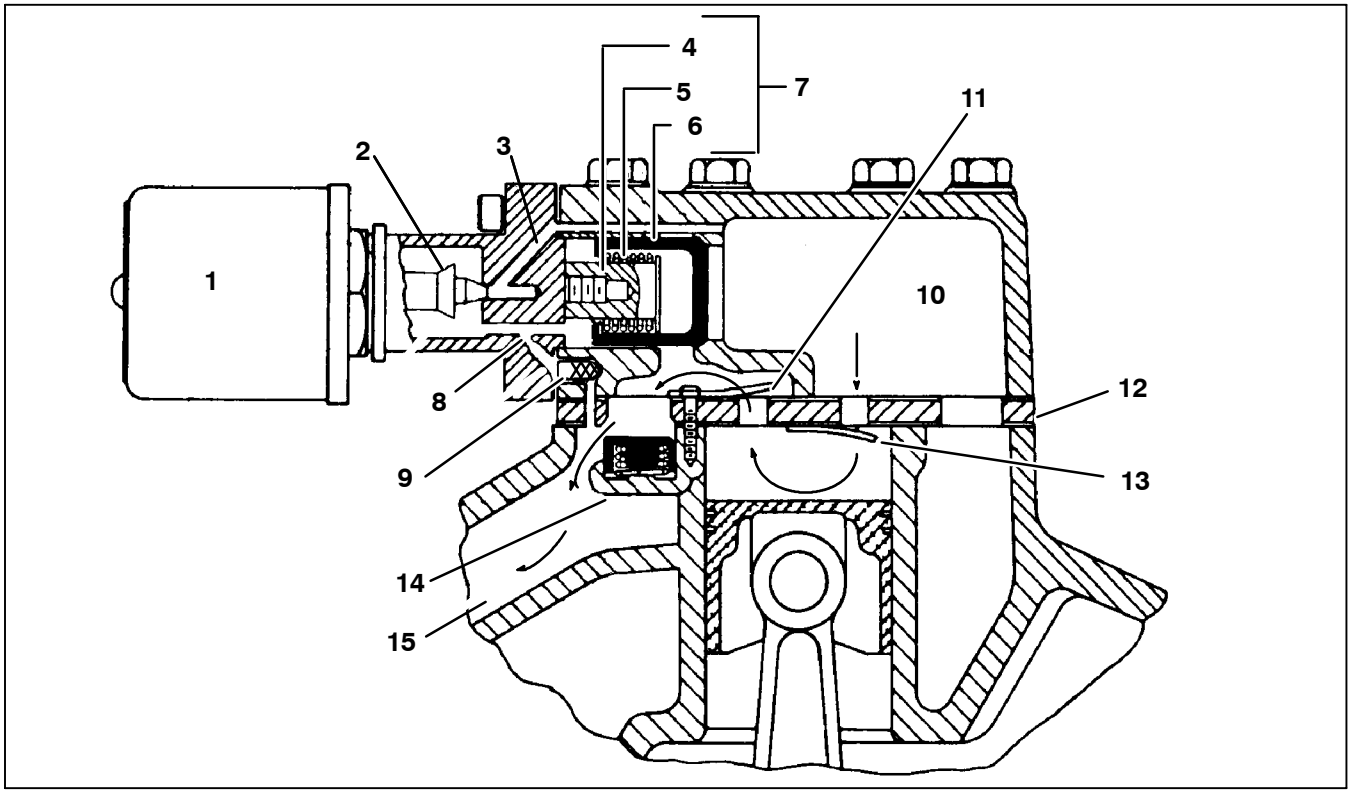
Discharge pressure bleeds from the discharge manifold (Figure 2-13, item 15) through the strainer (9) and (8) bleed orifice to the solenoid valve stem (2) chamber and the back of the piston bypass valve (7).

With the solenoid valve (1) *de-energized,* the solenoid valve stem will *close* the gas bypass port (3).

Refrigerant pressure will overcome the bypass valve spring (5) tension and force the piston (6) *forward closing* the gas bypass from the discharge manifold to the suction manifold (10).

Cylinder discharge pressure will force open the discharge piston check valve assembly (14). Refrigerant gas will pass into the compressor discharge manifold.

The loaded cylinder bank will continue to operate fully loaded until the solenoid valve control device is energized and the gas bypass port is opened. Refer to Section 4.4.9 for more information on Loaded Operation.



1. Solenoid Valve
2. Valve Stem
3. Gas Bypass Port
4. Spring Guide
5. Spring
6. Piston
7. Piston Bypass Valve
8. Bleed Orifice
9. Strainer
10. Suction Manifold
11. Cylinder Discharge Valve
12. Valve Plate
13. Cylinder Suction Valve
14. Discharge Piston Check Valve Assembly
15. Discharge Manifold

Figure 2-13. Compressor Cylinder Head Loaded

2.3.5 Filter Drier

The drier is a cylinder shell containing a drying agent and screen. It is installed in the liquid line, and functions to keep the system clean and remove moisture from the refrigerant.

2.3.6 Receiver

Liquid refrigerant from the condenser drains into the receiver. The receiver serves as a liquid reservoir when there are surges due to load changes in the system; as a storage space when pumping down the system and as a liquid seal against the entrance of refrigerant gas into the liquid line.

The receiver is provided with two bulls eye sight glasses for the observation of liquid level and a pressure relief valve.

2.3.7 Transducers and Sensors

a. Compressor Suction Pressure Transducer (CSP)

Provides micro with suction pressure information to be displayed, recorded in the DataRecorder and used to control the refrigeration system. It cannot be calibrated. It is located near the oil pump on the compressor.

b. Compressor Discharge Pressure Transducer (CDP)

Provides micro with discharge pressure information to be displayed, recorded in the DataRecorder and used to control the refrigeration system. It can be calibrated. It is located on the center cylinder head of the compressor.

c. Compressor Discharge Temperature Sensor Transducer (CDT)

Provides micro with discharge temperature information to be displayed, recorded in the DataRecorder and used to control the refrigeration system. It is located on the center cylinder head of the compressor.

It will shut the unit down if center compressor head discharge temperature reaches 310°F (154°C) for three minutes or 350°F (177°C). If ambient temperature sensor (AAT) is at 120°F (49°C) or higher, the CDT limits are increased to 340°F (171°C) for three minutes.

d. Compressor Suction Modulation Valve (CSMV)

The CSMV opens and closes as required for capacity control of the refrigeration system cooling cycle. It is located in the suction line at the exit of the evaporator pod.

e. Ambient Air Temperature Sensor (AAT)

AAT is a temperature control probe which provides micro with ambient air temperature information to be displayed, recorded in the DataRecorder and used to control the refrigeration system. It is located behind the condenser grille.

2.4 EVAPORATOR SECTION

The evaporator fits into a rectangular opening in the upper portion of the refrigerated compartment front wall. When installed, the evaporator section is located inside this compartment, and the condensing section is outside.

The evaporator assembly consists of an evaporator coil, evaporator fan, expansion valve, a defrost thermostat (termination switch). The location of the thermostat is shown in Figure 2-7. The return air sensor is also shown in Figure 2-7.

2.4.1 Thermal Expansion Valve

The thermal expansion valve is an automatic device which controls the flow of liquid to the evaporator according to changes in superheat to the refrigerant leaving the evaporator. The thermal expansion valve maintains a relatively constant degree of superheat in the gas leaving the evaporator regardless of suction pressure. Thus, the valve has a dual function; automatic expansion control and prevention of liquid return to the compressor.

2.4.2 Heat Exchanger

The heat exchanger is of the “tube in tube” type connected in the main suction line and liquid line. Within the heat exchanger, the cold suction gas is used to cool the warm liquid refrigerant. This results in greater system capacity and efficiency.

2.4.3 Evaporator Coil

The unit evaporator is a tube and fin type. The operation of the compressor maintains a reduced pressure within the coil. At this reduced pressure, the liquid refrigerant evaporates at a temperature sufficiently low enough to absorb heat from the air.

Heating is accomplished by circulating hot gas directly from the compressor to the evaporator coil. Solenoid valves control the refrigerant circuit to operate the heating/cooling system.

Automatic evaporator coil defrosting is initiated by either sensing the air pressure drop across the coil with a differential air switch or with the defrost timer in the microprocessor.

As perishable products respire, they consume oxygen (O_2) and give off carbon dioxide (CO_2). This will eventually cause the atmosphere within a refrigerated compartment to have higher levels of CO_2 and lower levels of O_2. This may adversely affect the shelf life of some sensitive perishable products. When transporting these products, it may be desirable to maintain normal atmospheric conditions (prevent the build up of CO_2 and the depletion of O_2) by using fresh air exchange, in addition to accurate temperature control. AutoFresh Air Exchange provides the ability to control the amount of fresh air without the need for manual intervention while in transit. AutoFresh Air Exchange can also be used to lower the humidity level within a refrigerated compartment IF the ambient air has a lower humidity level.

AutoFresh Air Exchange is a factory-installed option, as it requires a modified evaporator pod. (See Figure 2-7) When AutoFresh Air Exchange is operational and “ON”, two air ports open. The upper port allows fresh ambient air to enter while stale air exits through the lower port. AutoFresh Air Exchange is available for all setpoints at or above +28°F (-2.2°C). AutoFresh Air Exchange is not operational when the setpoint is set below +28°F (-2.2°C) or when the unit is in Defrost, or when the unit has cycled off in Auto Start-Stop.

2.5 SYSTEM OPERATING CONTROLS AND COMPONENTS

The temperature controller is a Carrier Transicold Advance Microprocessor controller (Refer to Section 2.5.3 and 3). Once the controller is set at the desired temperature, the unit will operate automatically to maintain the desired temperature within very close limits.

The control box includes manual switches, microprocessor, fuses, and associated wiring. Also, the unit can be equipped with an optional remote light bar which mounts separately and can be seen in the mirror from the cab of a truck, or on the front of a rail car.

Standard equipment includes an Auto Start-Stop feature. This feature provides automatic cycling of the diesel engine, which in turn offers an energy efficient alternative to continuous operation of the engine with control of temperature by alternate cooling and heating of the supply air (evaporator outlet air).

2.5.1 Multiple Languages

Messages in the MessageCenter can be displayed in English, French or Spanish.

2.5.2 Special Features

The following special features are incorporated into the Carrier Transicold Advance Microprocessor:

- A MessageCenter which clearly displays all information in dot matrix form.
- Unit Operation and Alarms are displayed in English (not in codes)
- UltraFresh 3
- Large LCD display
- Unit Data and Functional Parameters
- Programmable Maintenance hourmeters
- PM Hourmeters are resettable from the keypad
- Bright LED alarm light
- Bright LED mode lights
- Fully automated Pretrip
- Automated Micro Self-test
- DataRecorder
- DataRecorder date and time can be set from the keypad
- Auto Start-Stop
- Trip Start to record date/time of trip in DataRecorder memory
- PC card functionality for downloading data, upgrading programming and configuration set up. (See Section 2.5.4.)
- FETs (Field Effect Transistors) for switching components on and off, and checking circuit current
- Automatic Engine Starting. Manual engine starting exists in units built before April 2007.
- Functional Parameter locks
- Alarms are stored in microprocessor memory for future reference
- New menu system to simplify keyboard and enhance functionality

2.5.3 Component Description And Location

a. Control Module

The control module is housed in the control box on the lower roadside (right) corner of the unit, just inside the lower roadside door. The control module contains replaceable relays and fuses which are externally accessible. LEDs are located next to the three relays plugged into the control module to indicate relay operation. Additional LEDs indicate operation of the FETs (Field Effect Transistors).

The control module includes the logic board, program memory, FETs, PC card slot, and necessary input/output circuitry to interface with the unit.

The logic board is located within the control module, and does not contain any serviceable components.

⚠ CAUTION

Under no circumstances should anyone attempt to repair the Logic or Display boards. Should a problem develop with either of these components, contact your nearest Carrier Transicold dealer for replacement.

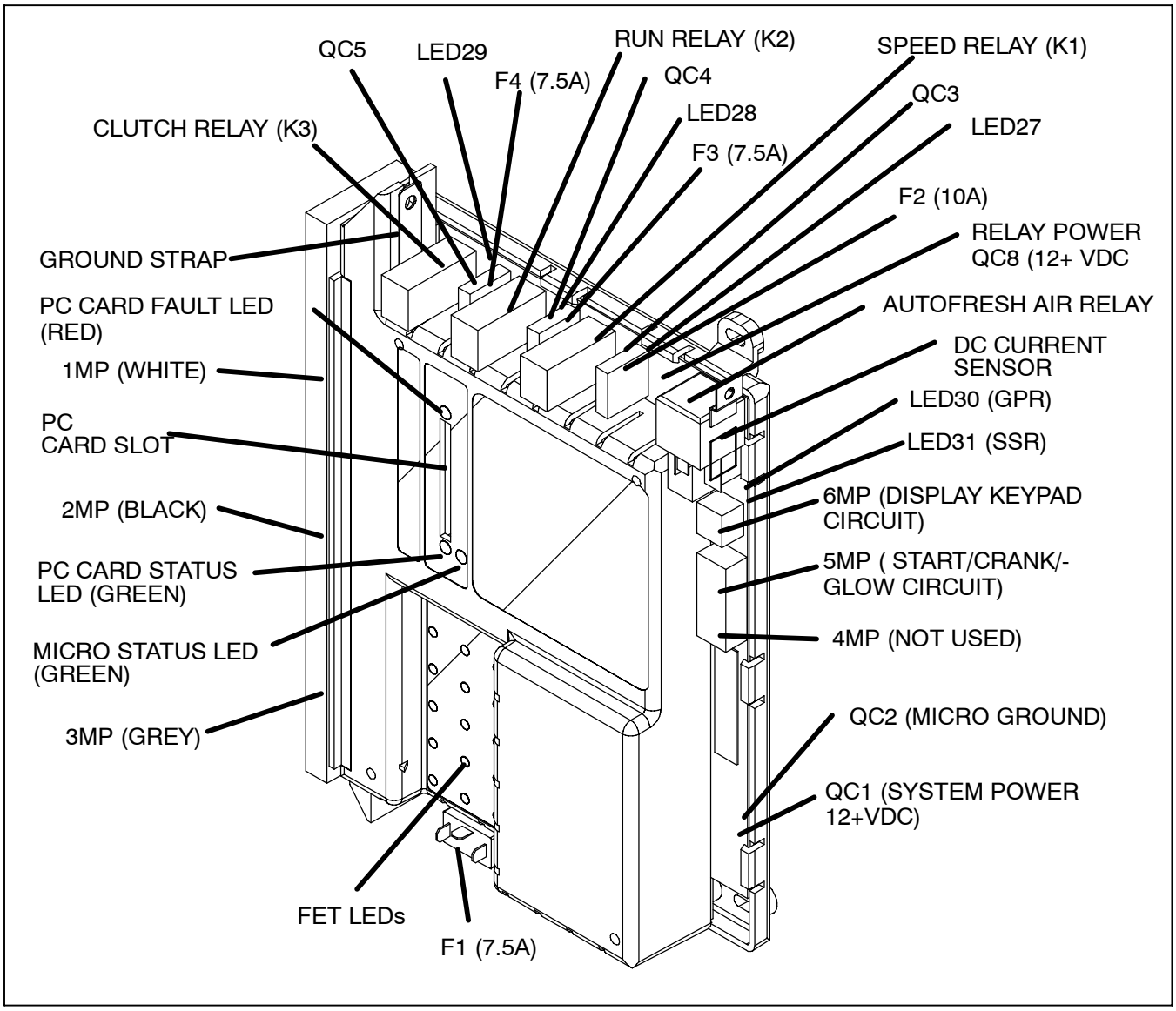


Figure 2-14. Control Module

Figure 2-14 shows the control module. The control module has three relays and four fuses that are user accessible. There are three 7.5 amp fuses and one 10 amp fuse.

The PC card slot is also shown in Figure 2-14. This card slot is used with all Carrier Transicold PC cards. The controller automatically detects the presence and type of PC card inserted and responds accordingly. The different types of PC cards are:

- Download PC card for downloading unit data
- Option PC card for installing optional software programs
- Configuration PC card for setting the microprocessor functions, configurations, and DataRecorder configurations.
- Program PC card for upgrading the microprocessor software.

There are three LEDs associated with the function of the PC card slot. These are:

- A green Micro Status LED which will blink steadily once per second indicating that the microprocessor is operating and will blink every 0.5 seconds if there is no software or if it is loading software.
- A green (PC) Card Status LED which comes on when there is a PC card inserted in the slot. This LED will:

1. Blink every 0.5 seconds when data is being transferred to or from the PC card, and will be on steady when the operation is complete and the PC card may be removed.
2. During download, the light will blink once per second and will blink every 1.5 seconds when the download is complete.

- A red (PC) Card Fault LED blinks if there is a problem transferring data from the PC card that has been plugged into the PC card slot. The red LED will continue to blink until the PC card is removed. The LED will also blink if there is an error reading the card. The LED will blink every 0.5 seconds during a software change – either an upgrade or downgrade. It will blink every 1.0 seconds during data download to PC card. It will blink every 2.0 seconds when either the Program or Configuration or Option cards is inserted and no action is taken. Check the MessageCenter for description of error.

2.5.4 Handling of PC Cards

PC cards can be used to upgrade software (Section 5.4.2) download recorder data (Section 5.6.1, set configurations and functional parameters (Section 5.6.7) and install optional features.

While these cards are constructed for a rugged environment, they are not intended to be stored in a technician's toolbox.

The label on each card clearly states that the card is to be handled with care – not to be bent, dropped or exposed to impact. Heat, moisture and direct sunlight should be avoided.

PC cards are designed to be used in a wide temperature range of –40 to +185°F (–40 to +85°C). When a PC card is connected to an Advance controller or computer at temperatures outside this range, data transmission between the card and the other device may not be performed correctly.

Retention of programmed data for extended periods of time requires a temperature range of –4 to +149°F (–20 to +65° C). When PC cards are exposed to temperatures outside of this range for several days data contained on the card may be damaged.

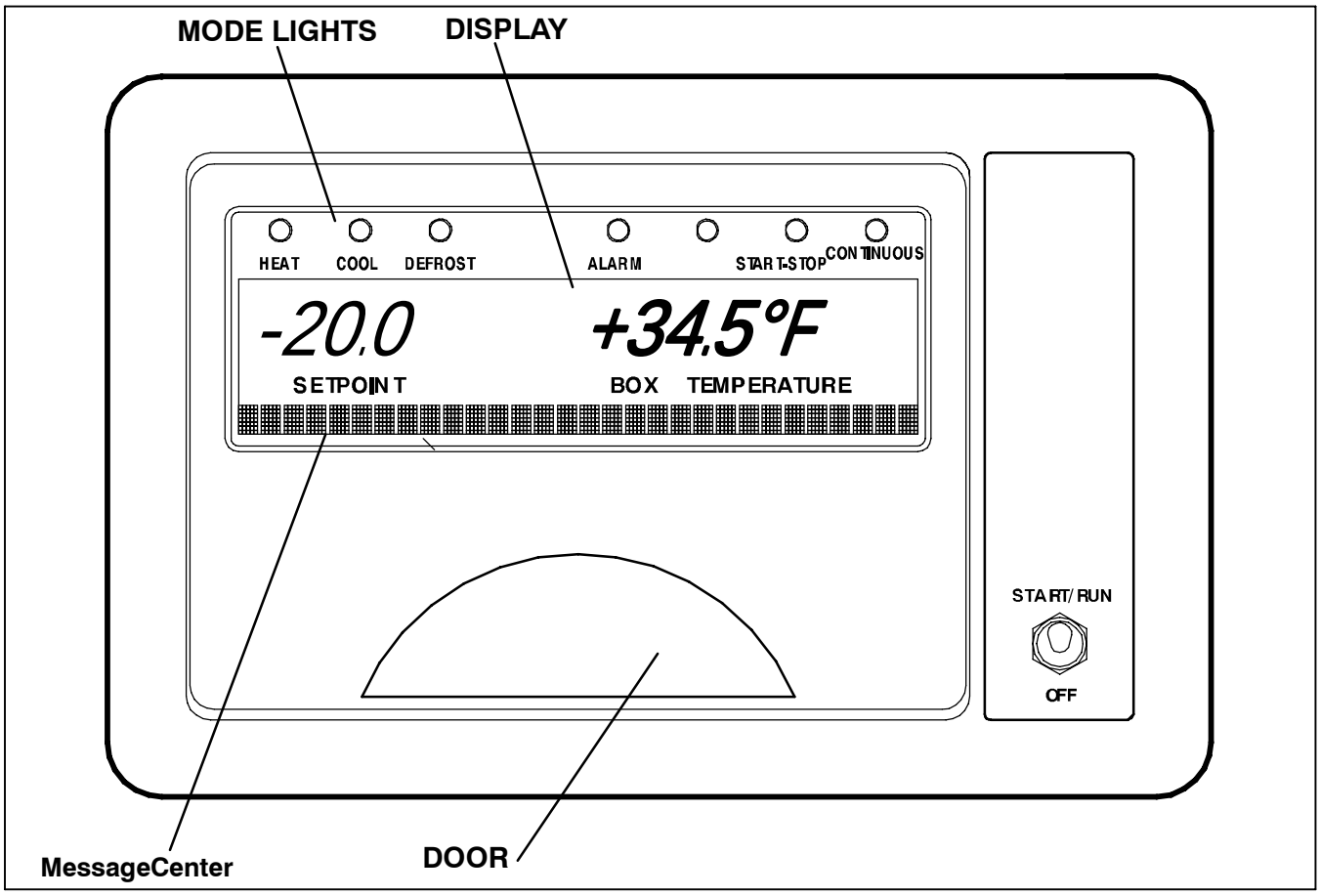
PC cards should never be:

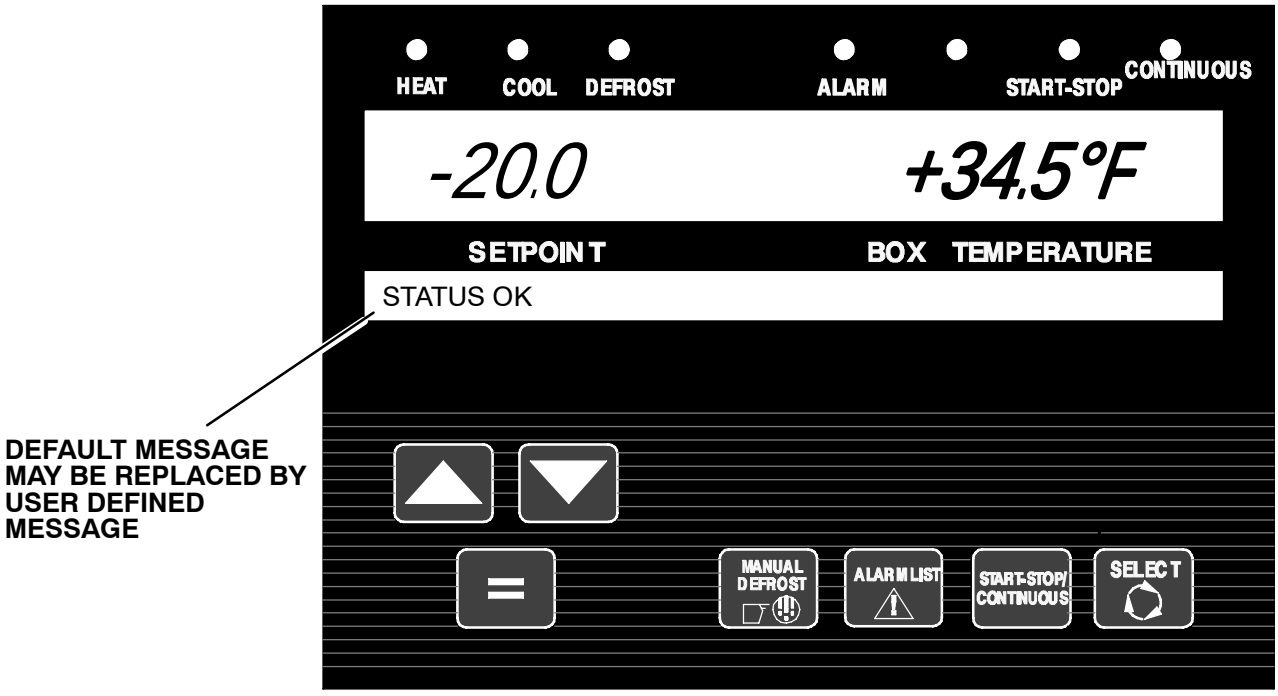
- Dropped
- Bent
- Twisted
- Squeezed
- Submersed in any liquid
- Exposed to electrostatic discharge
- Exposed to intense ultraviolet light
- Exposed to close–by magnetic or electromagnetic fields

Low X–Ray exposure, i.e. that experienced while passing through a security screen, should not harm the card data. High X–Ray exposure, i.e. that experienced in a medical or dental environment may damage the card data. PC cards should not be kept in a shirt pocket contained a pocket screwdriver with a magnetic end.

PC cards should be kept in a hard plastic jewel case when not in use. Replacement cases P/N 58–50109–00 are available from Replacement Components Division.

b. Display and Keypad





DISPLAY and KEYPAD MODULE

The Display and Keypad module is located for operator access at the lower roadside corner of the unit.

The display board is mounted in the Keypad and Display module. The display board includes the LCD display, keypad, and keypad interface.

The Display and Keypad module provides the user with a panel to view and control the functions of the refrigeration unit. The module consists of a switch, keypad, MessageCenter, and main display. Setpoints and other system information are selected using the keypad. The previous figure shows the Display and Keypad module.

Display

The main display has nine characters (seven seven-segment characters and two nine-segment characters), two decimal points, two commas, and a degree symbol. The display is used to provide the user a setpoint and refrigerated compartment temperature, either in degrees Centigrade or Fahrenheit. The comma symbols are used as the decimal indicators in Europe. When Metric Units is selected in the Functional Parameters, the two comma icons are used instead of decimal points. When English Units is selected in the Functional Parameters, decimal points are used.

Temperature display is right justified, with unused digits blank. A negative sign will be displayed for all setpoint and refrigerated compartment temperatures below Zero. A positive sign will be displayed for all setpoint and refrigerated compartment temperatures above 0° which will not have a sign in front of it. The resolution for refrigerated compartment temperature in both Centigrade and Fahrenheit is one-tenth degree.

The user has the option as to whether to have the setpoint displayed with a decimal or comma. Only setpoint is affected by this selection. All other temperatures and pressures will continue to be displayed with either a decimal or comma. Refer to Configurations Section 5.2.

Indicator LEDs

The display has six LEDs across the top to indicate operation status. These indicators are:

- Cool Indicator (Green) – Turned on when the unit is in Cool mode.
- Heat Indicator (Amber) – Turned on when the unit is in Heat mode.
- Defrost Indicator (Amber) – Turned on when the unit is in Defrost mode.
- Start-Stop Indicator (Green) – Turned on when the Start-Stop mode has been selected.
- Continuous Indicator (Green) – Turned on when the Continuous mode has been selected.
- Alarm Indicator (Red) – Off or flashes at a rate of 0.5 seconds.

NOTE

There is an opening between the Alarm and Start-Stop LEDs that is not used at this time.

MessageCenter

The MessageCenter is used to show messages. Details of the messages are described in Section 6.1 MessageCenter.

Switch Descriptions

START/RUN-OFF Switch

The START/RUN-OFF switch is a 12 VDC input to the microprocessor. When placed in the START/RUN position, this switch activates the Control module. To stop the unit, move the switch to the OFF position.

WARNING

UNITS EQUIPPED WITH STAR-TRAK TWO WAY COMMUNICATION CAPABILITIES MAY HAVE THE ABILITY TO BE STARTED OR TURNED OFF REMOTELY REGARDLESS OF THE SETTING OF THE START/RUN-OFF SWITCH.

The unit is controlled locally and there can be no two-way communication when the Mode Switch on the Remote Monitoring Control Box is in MAINTENANCE MODE. Therefore, when performing any work on the unit place the mode switch in MAINTENANCE MODE. After the unit is serviced, return the mode switch to REMOTE ON. (Refer to Section 3.19.3 for more information on two-way communication.)

GLOW/CRANK Switch (GCS) (Removed from units built after April 2007)

The GLOW/CRANK switch is located on the back of the control box and is easily reachable from under the control box.

NOTE

The GLOW/CRANK switch will energize the glow and crank circuits only when the START/RUN-OFF switch is in the RUN position, and after the microprocessor has gone through the self-test.

Key Descriptions

UP ARROW and DOWN ARROW Keys

These keys allow you to change the setpoints or other displayed data of the system. They also allow you to scroll through the Unit Data list, Function Parameters list, Alarm list, etc.

EQUAL Key (ENTER)

The EQUAL key is used for many things, including entering a setpoint, changing a Functional Parameter, clearing alarms, and locking the data menu.

MANUAL DEFROST Key

The MANUAL DEFROST key is used to initiate a defrost cycle when the proper conditions are met.

ALARM LIST Key

The ALARM LIST key allows you to view the alarms stored in the microprocessor. The alarm list is displayed in the MessageCenter. Pressing the ALARM LIST key once displays the active alarm list. Each successive press cycles through the list to the end. To view the inactive alarm list, Refer to Section 3.12.

START-STOP/CONTINUOUS Key

This key allows you to change from Start-Stop operation to Continuous Run operation. In Start-Stop operation, when the controller is in Off-Cycle mode, the unit will not be running. During Off-Cycle mode, the microprocessor monitors refrigerated compartment temperature, battery voltage and engine coolant temperature and will restart the unit when needed.

SELECT Key

Press the SELECT key to scroll through the menu selections. One of the five standard and one optional menu selections will appear when the SELECT key is pressed. These are: PRETRIP, DATA, FUNCTION CHANGE, TRIP START or PRINT, or one optional selection – IntelliSet, will appear in the MessageCenter. Repeated presses of the SELECT key will sequence the menu through the selections. The menu will wrap around. Press the SELECT key until the desired menu selection appears in the MessageCenter.

The five standard selections are:

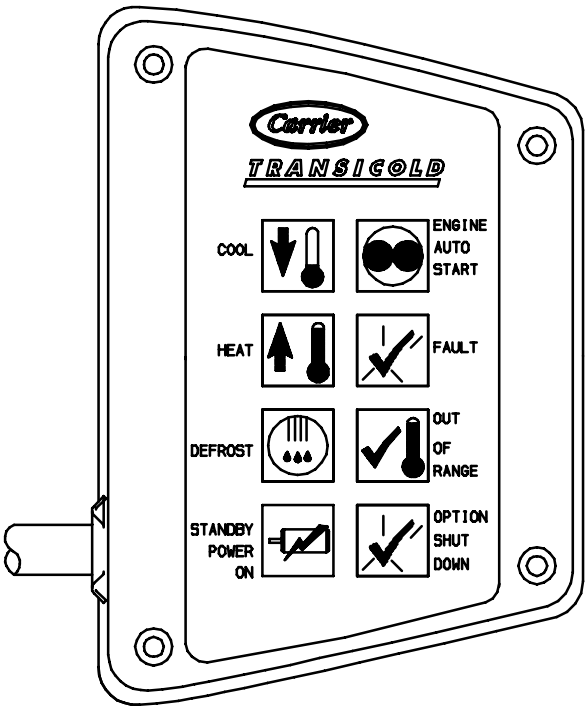
- **PRETRIP** – Used to initiate a Pretrip.
- **DATA** – Displays Unit Data. Refer to Section 3.13.
- **FUNCTION CHANGE** – Displays unit Functional Parameter settings. Refer to Functional Change (Parameters), Section 3.15.
- **TRIP START** – This menu selection is only used with the DataRecorder. It is used to record a Trip Start event which is logged in the DataRecorder. This records the time and date of the beginning of the trip. Data can then be downloaded and reviewed by trip, making data review much easier.
- **PRINT** – Enables the user to use hand-held Strip Print printer kit P/N 12-00543-10.

The optional selection is:

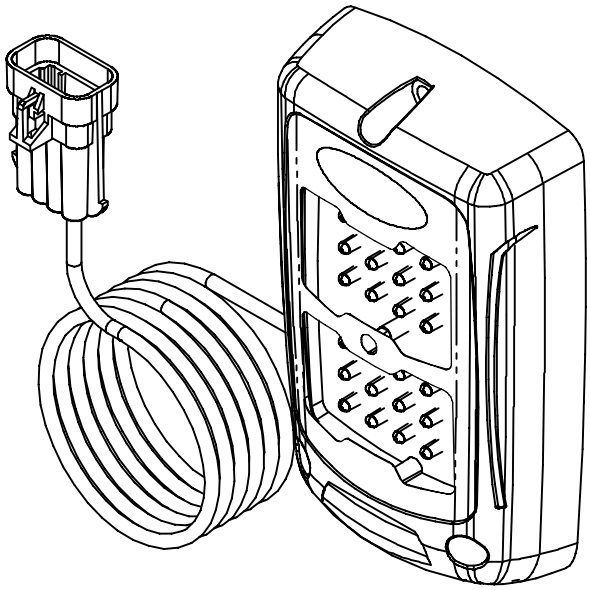
- **INTELLISET** – Refer to Section 3.19.1.

c. Light Bar

The Light Bar is an external set of indicator lights that can be seen in the mirror from the cab of a truck or on the front of a rail car. They are controlled by the microprocessor. These lights correspond to the microprocessor LEDs – HEAT, COOL, DEFROST, START-STOP, and ALARM. The ENGINE-AUTO-START light is only illuminated when the unit is operating in Start-Stop. The OUT-OF-RANGE light is illuminated when the Out-of-Range Alarm is active.



STANDARD LIGHT BAR



LED. LIGHT BAR

d. Door and Remote Switches

The unit has provisions to install a Door switch (DS), and up to two remote switches (REMS1 and 2), and connect them to the microprocessor so that when the door is opened (or a remote switch is turned on/off), either an alarm is displayed, or the unit may be programmed to shut down. Either event may also be recorded by the DataRecorder.

Because different door switches are available, there are provisions within the Configuration list to configure the microprocessor to correctly read the type of switch that is installed. The microprocessor will recognize switches with contacts that are either open when the door is open, or that are closed when the door is open. Additionally, the Configuration list gives you the ability to determine whether the switch will: enable the alarm only, enable the alarm and also shut the unit down, enable the alarm and put the unit into low speed while the door is open, or to have no alarm and only record door openings and closings in the DataRecorder.

If the Door switch or Remote switches are configured to shut the unit down when either the door or remote switches is open, the unit will shut down for a minimum of three minutes. Additionally, there is an Override Door switch in the functional parameters (Refer to Functional Parameter List, Section 3.15.) When this switch is turned OFF, the Door switch or Remote Switch Alarm(s) will come on as needed; however, the unit will not shut down.

e. Out of Range Alarm

The Out Of Range Alarm is intended to notify the driver when the refrigerated compartment temperature is moving away from the setpoint. The Out Of Range Alarm may be configured as an Alarm Only, or as an Alarm and Unit Shutdown. (Refer to Section 5.2 Configuration mode)

Generally, before the Out of Range Alarm can be triggered, the refrigerated compartment temperature must have first been In Range. In Range is defined as the refrigerated compartment temperature having been within ± 2.7°F (1.5°C) of setpoint in the Perishable Range, or within + 2.7°F (1.5°C) of setpoint in the Frozen Range.

If the unit shuts down due to a shutdown alarm, the Out Of Range alarm will come on after the timer expires (30 or 45 minutes), and when the refrigerated compartment temperature goes out of range, regardless if the refrigerated compartment temperature was ever within setpoint range or not.

Out of Range is determined by the Functional Parameter setting. Selections of 4°F (2°C), 5.5°F (3°C), 7°F (4°C), and OFF are available. The OFF setting disables the Out of Range alarm. All other settings allow the user to determine how far away from setpoint the refrigerated compartment temperature may move before turning on the alarm. Once the refrigerated compartment temperature has moved the away from setpoint by the selected amount, the Out of Range timer begins. If the alarm is configured for Alarm Only, after 30 minutes the alarm will be activated. If the alarm is configured for Alarm Shutdown, after 45 minutes the alarm will be activated and the unit will shutdown.

In Sleep mode, Pretrip, Diagnostic Test mode, Component Test mode, or if the unit has a Door switch, and the door has been opened, the Out of Range alarm is not in use. After exiting any of these modes, or closing the trailer or rail car door, the refrigerated compartment temperature must again come In Range of the setpoint before the Out of Range alarm can be activated.

In Defrost and in Start-Stop Off Cycle, the 15 or 45 minute timer does not count. Once the unit leaves these modes, and goes into a temperature control mode (heat, cool, or null), the timer will be reset for the full time, allowing the unit either 15 or 45 minutes to bring the refrigerated compartment temperature into range before activating the Out of Range alarm.

If the unit is not heating or cooling correctly, the Out of Range alarm may come on when:

- The unit is in cool and RAT plus SAT divided by 2 is more than setpoint and delta-T is not at least -10°F (0.56°C) for 30 minutes.
- The unit is in heat and RAT plus SAT divided by 2 is less than setpoint and delta-T is 0° or less for 30 minutes.

2.6 ENGINE DATA

Table 2-3. Engine Data

Engine Model	CT4-134DI (V2203-DI-E2B)
	V2203-DI-ESC
Displacement	134 in^3 (2.2 liters)
No. Cylinders	4
Weight	417.8 lbs (189.5 kg)
Coolant Capacity	2 gallons (7.6 liters) (50/50 mix – never to exceed 60/40)
Oil Capacity with Filter	15 quarts (14 liters)
Fuel	Winter: Diesel No. 1 Summer: Diesel No. 2
Glow Plug Amperage	7.0 amps per plug at 10.5 VDC (nominal)

⚠ CAUTION

Use only ethylene glycol anti-freeze (with inhibitors) in system as glycol by itself will damage the cooling system. Always add pre-mixed 50/50 anti-freeze and water to radiator/engine. Never exceed more than a 60% concentration of anti-freeze. Use a low silicate anti-freeze meeting GM specifications GM 6038M for standard life coolant or use Texaco Havoline extended life coolant or any other extended life coolant which is Dexcool approved and has 5/150 (5 years/150,000 miles) on the label.

2.6.1 Lubrication System

a.Oil Pressure

40 to 60 PSIG (2.7 To 4.1 Bars)
(Engine in high speed)

b.Oil Pressure Safety Switch Setting Closes

15 (± 3) PSIG [1.02(±.2) Bars]

c.Lube Oil Viscosity:

Outdoor Temperature		SAE
Centigrade	Fahrenheit	
0°	Below 32°	10W or 15W40
0° to 25°	32° to 77°	20W or 15W40
Over +25°	Over 77°	30W or 15W40

Extended Service Interval (ESI) packages are standard on X units beginning with S/N JAB90602792. The ESI package reduces the frequency of scheduled service intervals. The two tables below reflect the differences between standard and ESI packages.

Oil Change Intervals - Standard Service Interval	
API Class CI or higher	MOBIL DELVAC 1
2000 Hours or 1 yr	4000 Hours or 1 yr

Oil Change Intervals - Extended Service Interval	
API Class CG or higher	MOBIL DELVAC 1
3000 Hours or 2 yr	4000 Hours or 2 yr

⚠ CAUTION

When changing oil filters, the new filters should be primed (partially filled) with clean oil if possible. If the filters are not primed, the engine may operate for a period with no oil supplied to the bearings.

NOTE

The maximum oil change interval is one year for CG oil or two years for Mobil Delvac 1 unless units are equipped with Extended Service Interval Packages. The only approved synthetic lube oil is Mobil Delvac 1. The normal oil change intervals should be reduced if the equipment is operated under extreme conditions such as in dirty environments.

Refer to Section 8.1 for more detailed information on service intervals.

2.7 ENGINE SCREW THREADS

All threads used on the diesel engine are metric.

2.8 ENGINE AIR SYSTEM

The air cleaner is installed on the engine to prolong its life and performance by preventing dirt and grit from getting into the engine causing excessive wear on all operating parts. However, it is the responsibility of the operator to give the air cleaner equipment regular and constant attention in accordance with the instructions. (Refer to section 8.6.6)

Clean air is supplied to the engine through the air cleaner. The air is necessary for complete combustion and scavenging of the exhaust gases. As the engine piston goes through the intake stroke, the piston draws clean fresh air down into the cylinder for the compression and power strokes. As the engine goes through its exhaust stroke, the upward movement of the piston forces the hot exhaust gases out of the cylinders through the exhaust valves and the exhaust manifold. If the air filter is allowed to become dirty, the operation of the engine would be impaired.

2.9 COMPRESSOR DATA

Table 2-4. Compressor Data

Compressor Model	05G
No. Cylinders	6
No. Unloaders	2
Weight	137 lbs (62 kg)
Oil Charge	5.5 pints (2.8 L)
Approved OIl	Mobil Arctic EAL 68

2.10 REFRIGERATION SYSTEM DATA

Table 2-5. Refrigeration System Data

Defrost Air Switch (DAS) Initiates Defrost:	1.40 (± .07) inch (35 ± 1.8 mm) WG
Expansion Valve Superheat Setting at 0°F (-17.8°C) refrigerated compartment temperature:	Setting: 8 to 10°F (4.4 to 5.6°C)
Expansion Valve MOP	105 PSIG (7.1 Bars) – Ultima and X2 2500
	55 PSIG (3.7 Bars) – Ultra and X2 2100
Fan Clutch Air Gap	0.015″ to 0.095″
Fusible Plug Setting	208 to 220°F (97.8° to 104.4°C)
High Pressure Switch (HP1)	**Cutout:** 465 ± 10 PSIG (32.7 ± 0.7 Bars) **Cut-in:** 350 ± 10 PSIG (24.6 ± 0.7 Bars)
Refrigeration Charge	Refer to Table 2-1
Gearbox Oil	Mobil SHC 75-90W: 15oz (0.43 kg)
Fanshaft Oil	Mobil SHC 630: 3.2oz (0.09 kg)
Unit Weight (Approximate)	1600 lb. (725 kg)

2.11 SAFETY DEVICES

System components are protected from damage caused by unsafe operating conditions by automatic shut-down of the unit when such conditions occur. This is accomplished by the safety devices listed in Table 2-6.

Table 2-6. Safety Devices

Unit Shutdown Safety Devices		
Unsafe Conditions	**Safety Device**	**Device Setting**
Low engine lubricating oil pressure	Oil pressure safety switch (ENOPS) (microprocessor reset)	Opens below 15 ± 3 PSIG (2.1 ± 1.2 Bars)
High engine cooling water temperature	Engine coolant temp. (ENCT) (microprocessor reset)	Refer to section 2.6
Excessive current draw by microprocessor	Fuse (F1)	Opens at 7 1/2 amps
Excessive current draw by speed relay	Fuse (F2)	Opens at 10 amps
Excessive current draw by run relay	Fuse (F3)	Opens at 7 1/2 amps
Excessive current draw by clutch relay	Fuse (F4)	Opens at 7 1/2 amps
Excessive current draw by glow plug circuit, control circuit or starter solenoid (SS)	Fuse (F5)	Opens at 80 amps
Excessive current draw by all solenoid valves and unloaders and light bar	Fuse (F6)	Opens at 15 amps
Excessive current draw by glow/crank switch and START/RUN-OFF switch (Glow/-Crank switch removed in units built after April 2007)	Fuse (F7)	Opens at 5 amps
Excessive current draw by fuel heater	Fuse (F8) – Optional	Opens at 20 amps
Excessive current draw by light bar	Fuse (F9)	Opens at 3 amps
Excessive current draw by Fresh Air Relay	Fuse (F10) – Optional	Opens at 40 amps
Excessive compressor discharge pressure	High pressure cutout switch (HPS) automatic reset	Refer to section 2.3.7
Other Safety Devices		
Unsafe Conditions	**Safety Device**	**Device Setting**
Low Engine Coolant Level	Engine Coolant Level Switch (ENCLS)	Engine coolant level is more than 1 quart low.
Low Engine Oil Level (May be configured for alarm only or alarm and shutdown)	Low Engine Oil Level Switch (ENOLS)	Engine oil level is more than 7 quarts low.
Low Fuel Level (May be configured for alarm only or alarm and shutdown)	Low Fuel Level Switch, or Low Fuel Level Sensor	See Trigger On criteria for alarms 1 and 19 in Section 7
Door Open (May be configured for alarm only or alarm and shutdown)	Door Switch or Remote Switch	See Trigger On criteria for Alarms 57, 58, and 61 in Section 7
Refrigerated compartment temperature Out Of Range (May be configured for alarm only or alarm and shutdown)	Microprocessor	See Trigger On criteria for Alarm 53 in Section 7

2.12 COMPONENT RESISTANCE AND CURRENT DRAW

Table 2-7. Component Resistance and Current Draw

Component	Ohms	Amps
SV1	7.8 ± 0.3 Ohms	0.10 to 2.0 Amps
SV2 and 4	10.6 ± 0.3 Ohms	0.75 to 2.0 Amps
AFAS (Auto Fresh Air Solenoid)	Cannot be accurately measured with coil commander in circuit	Pull in – 29 Amps Hold – 0.83 Amps
Unloader	10.6 ± 0.3 Ohms	1.0 to 2.0 Amps
Clutch	2.5 ± 0.2 Ohms	3.0 to 5.0 Amps
Speed solenoid (Units without ESC)	1.5 to 2.5 Ohms	3.0 – 8.0 Amps
Fuel solenoid (Units without ESC) Red-Black wires:	11.1 Ohms to 13.4 Ohms	0.25 to 2.0 Amps
Fuel and Speed Actuator (Units with ESC)	2.8 Ohms ±10% @68°F (20°C)	4 Amps Max
Engine Speed Sensor (Units with ESC)		22 mAmps Max
12VDC Relay 10-00328-00	72 Ohms ±10%	0.14 – 0.18 Amps
12VDC Relay 10-00385-00	80 Ohms ±15%	0.12 – 0.17 Amps
12VDC Relay 10-00328-02	97 Ohms ±10%	0.11 – 0.14 Amps
White-Black wires: Can not be accurately measured with Coil Commander in circuit.		30.0 to 40.0 Amps
Indicator lights (8 Light Bar Only)	4.8 ± 0.2 Ohms	NA
Unit non-running amps (See Note 2 in Section 7.2)		6 – 9 Amps
Glow Plug Amps Each Plug		6 – 9 Amps
Glow Plug Total Circuit		24 – 36 Amps
Starter Amps	NA	270 – 380 amps

2.13 REFRIGERANT CIRCUIT DURING COOLING (See Figure 2-15)

When cooling, the unit operates as a vapor compression refrigeration system. The main components of the system are: the (1) reciprocating compressor, (2) air-cooled condenser, (3) expansion valve, and (4) direct expansion evaporator.

The compressor raises the pressure and the temperature of the refrigerant and forces it through the discharge check valve and into the condenser tubes. The condenser fan circulates surrounding air over the outside of the condenser tubes. The tubes have fins designed to improve the transfer of heat from the refrigerant gas to the air. This removal of heat causes the refrigerant to liquify. Liquid refrigerant leaves the condenser and flows through the solenoid valve SV1 (normally open) and to the receiver.

The receiver stores the additional charge necessary for low ambient operation and for the heating and defrost modes. The receiver is equipped with a fusible plug, which melts if the refrigerant temperature is abnormally high and releases the refrigerant charge.

The refrigerant leaves the receiver and flows through the manual liquid line service valve (King valve) to the subcooler. The subcooler occupies a portion of the main condensing coil surface and gives off further heat to the passing air.

The refrigerant then flows through a filter-drier where an absorbent keeps the refrigerant clean and dry; and the electrically controlled liquid line solenoid valve, SV2 (normally closed), which starts or stops the flow of liquid refrigerant.

The refrigerant flows to the “Liquid/suction” heat exchanger. Here the liquid is further reduced in temperature by giving off some of its heat to the suction gas.

The liquid then flows to an externally equalized thermostatic expansion valve, which reduces the pressure of the liquid and meters the flow of liquid refrigerant to the evaporator to obtain maximum use of the evaporator heat transfer surface.

The refrigerant pressure drop caused by the expansion valve is accompanied by a drop in temperature so the low pressure, low temperature fluid that flows into the evaporator tubes is colder than the air that is circulated over the evaporator tubes by the evaporator fan. The evaporator tubes have aluminum fins to increase heat transfer; therefore heat is removed from the air circulated over the evaporator. This cold air is circulated throughout the refrigerated compartment to maintain the cargo at the desired temperature.

The transfer of heat from the air to the low temperature liquid refrigerant causes the liquid to vaporize.

This low temperature, low pressure vapor passes through the “suction line/liquid line” heat exchanger where it absorbs more heat from the high pressure/high temperature liquid and then returns to the compressor through the Suction Modulation Valve (CSMV). The CSMV controls the compressor suction pressure thereby matching the compressor capacity to the load.

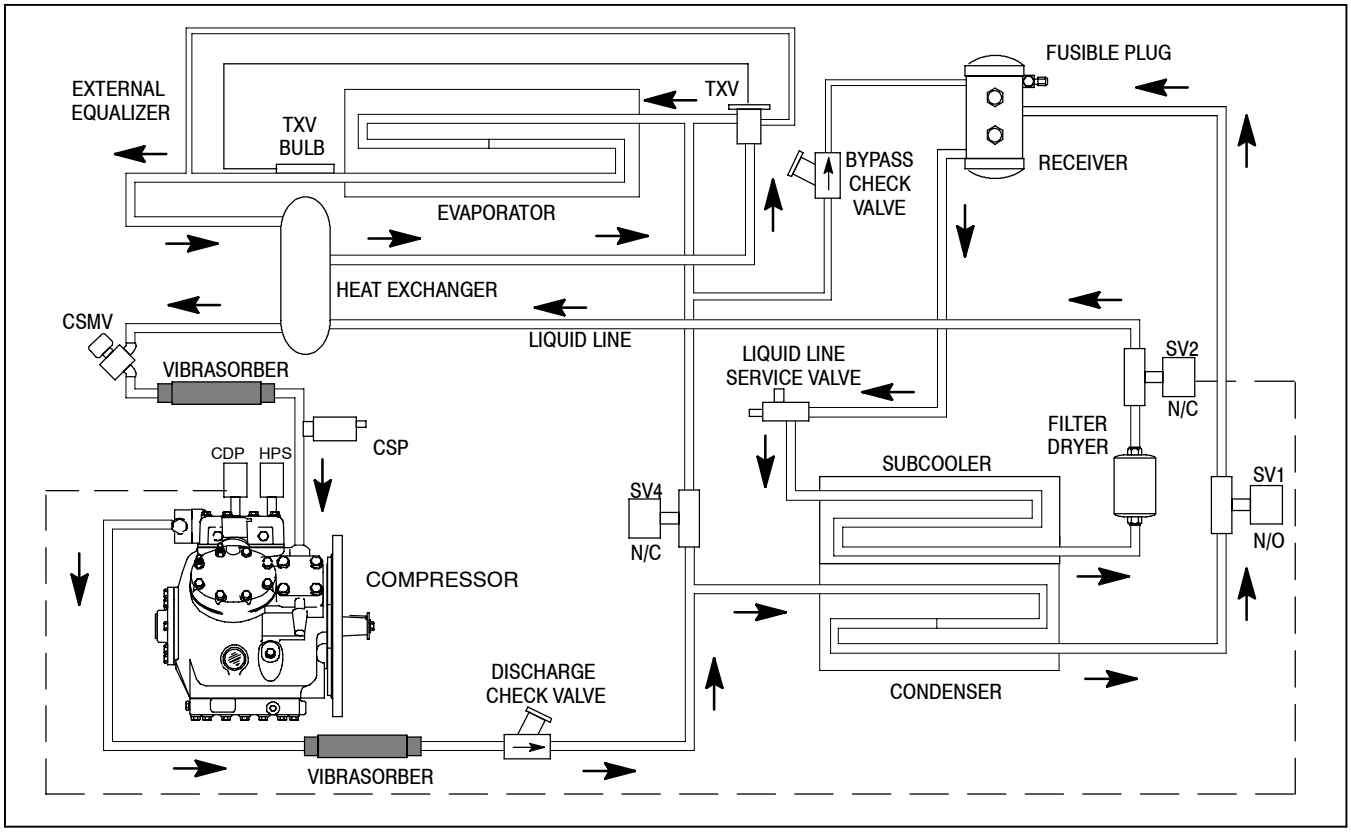


Figure 2-15. Refrigerant Circuit During Cooling

2.14 REFRIGERANT CIRCUIT – HEATING AND DEFROSTING (See Figure 2-16)

When vapor refrigerant is compressed to a high pressure and temperature in a reciprocating compressor, the mechanical energy necessary to operate the compressor is transferred to the gas as it is being compressed. This energy is referred to as the “heat of compression” and is used as the source of heat during the heating cycle.

When the controller calls for heating, the hot gas solenoid valve (SV4) opens and the condenser pressure control solenoid valve (SV1) closes. The condenser coil then fills with refrigerant, and hot gas from the compressor enters the evaporator. Also the liquid line solenoid valve (SV2) will remain energized (valve open) until the compressor discharge pressure increases to a predetermined setting in the microprocessor.

The microprocessor de-energizes the liquid line solenoid valve (SV2) and the valve closes to stop the flow of refrigerant to the expansion valve.

When additional heating capacity is required the microprocessor opens the Liquid Line Solenoid valve (SV2) to allow additional refrigerant to be metered into the hot gas cycle (through the expansion valve).

When in engine operation and the discharge pressure exceeds pressure settings detailed in Section 2.10, the pressure cutout switch (HPS) opens to de-energize the run relay coil (RR). When the RR coil is de-energized, the RR contacts open stopping the engine.

The function of the hot gas bypass line is to raise the receiver pressure when the ambient temperature is low (below -17.8°C/ 0°F) so that refrigerant flows from the receiver to the evaporator when needed.

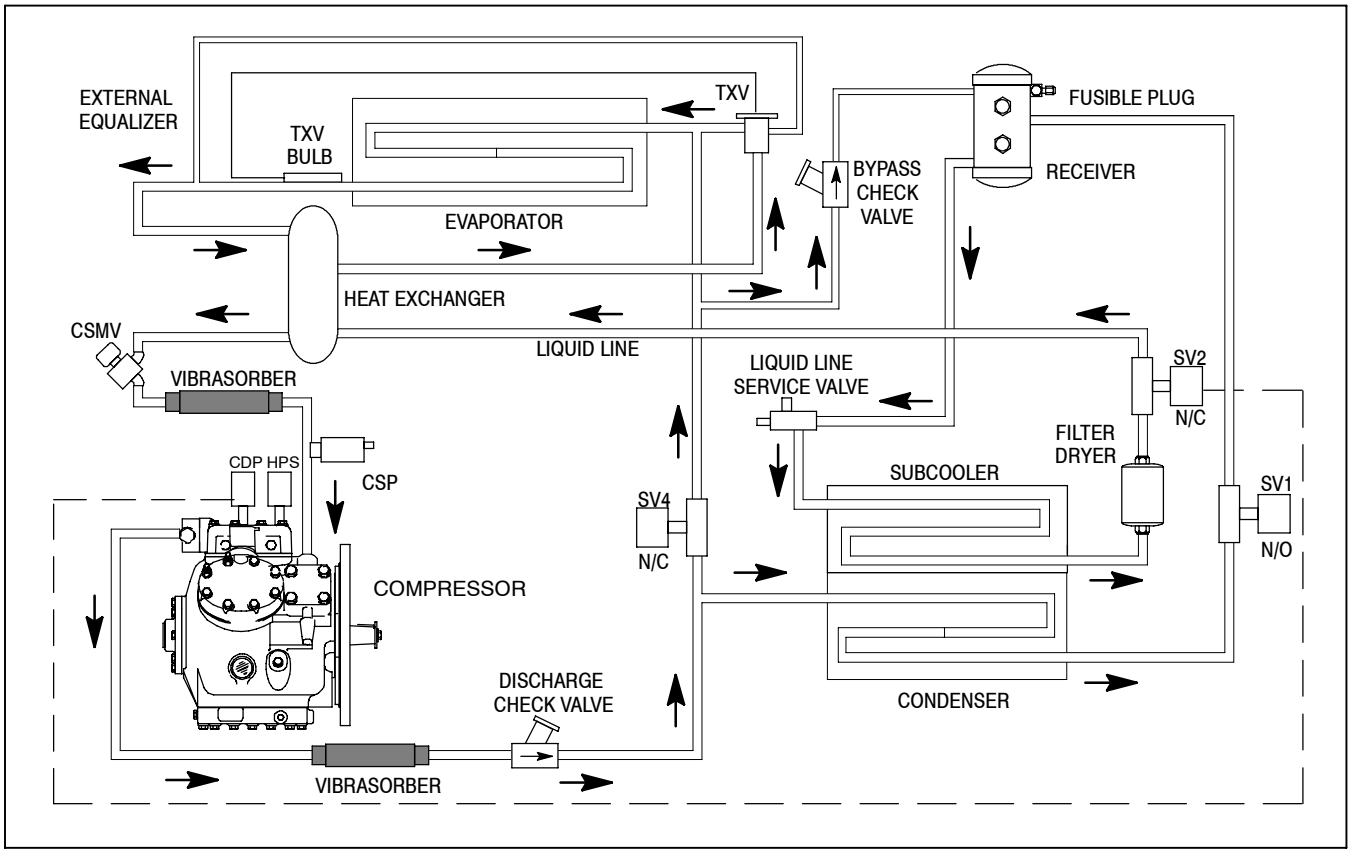
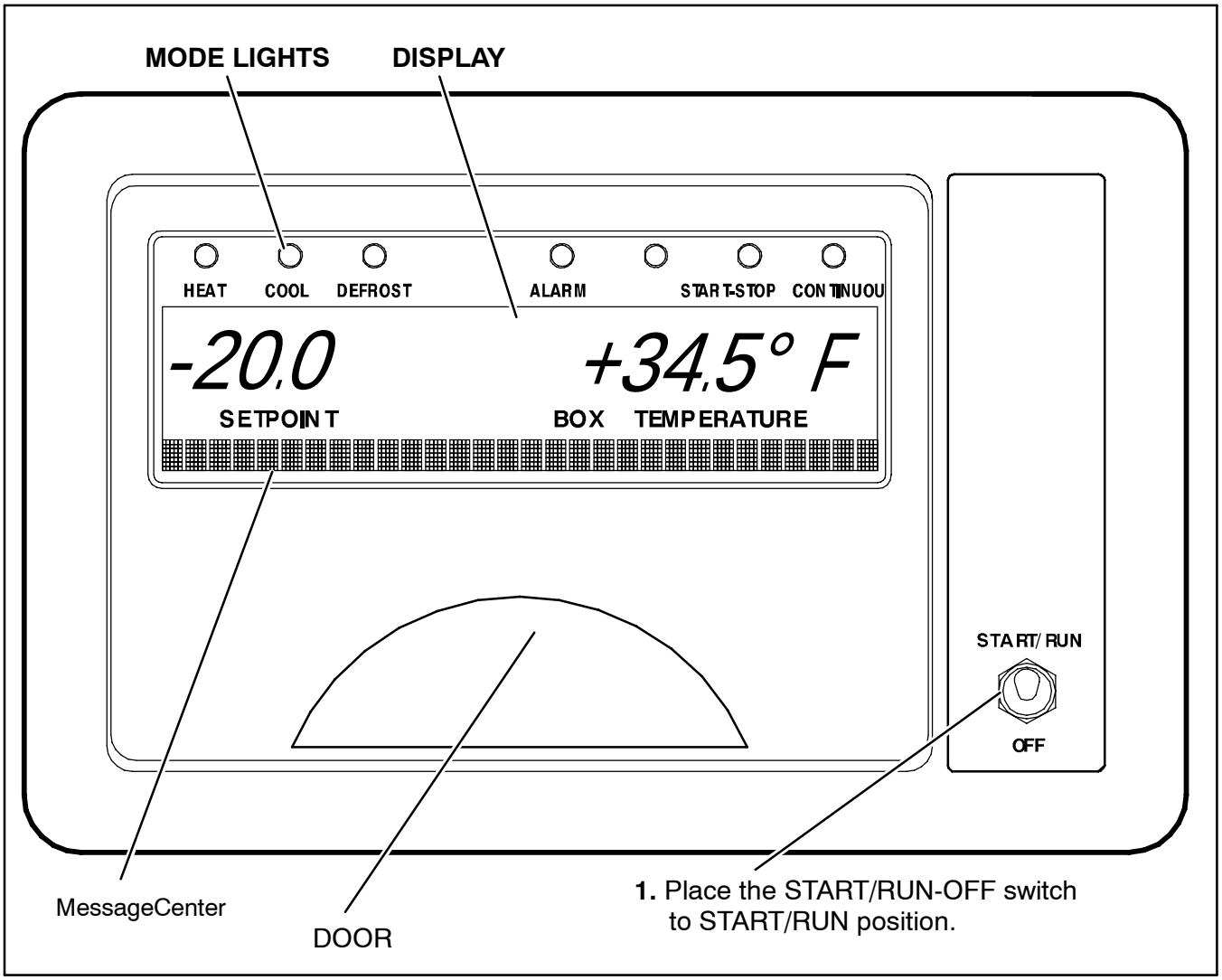


Figure 2-16. Refrigerant Circuit During Heating And Defrost

SECTION 3

OPERATION

3.1 STARTING UNIT – AUTO



When first powered up, the microprocessor controller will run a self test. All of the mode lights will light, all of the segments on the display will turn on, all of the Liquid Crystal Display (LCDs) in the MessageCenter will turn on to verify their operation.

The display will then show the setpoint temperature in the left four characters and the refrigerated compartment temperature in the right four characters. The last character (after the degree symbol) shows the temperature units as “C” Centigrade or “F” Fahrenheit. When set for °F, there is a decimal in the compartment Temperature. When set for °C, there is a comma in the compartment Temperature.

The MessageCenter will display the default message, unless there is an alarm(s) stored in the controller. If there is an alarm(s) stored in the controller,
“INACTIVE ALARMS IN MEMORY” will be displayed on the MessageCenter and the Alarm LED will flash for five seconds, then turn off.
“CHECK AT NEXT SERVICE INTERVAL” will then be displayed if there are any active non-shutdown alarms present. Total engine hours, total switch on hours (See Section 5.2.1) and the Active IntelliSet (Refer to Section 3.19.1) will also be shown when configured.

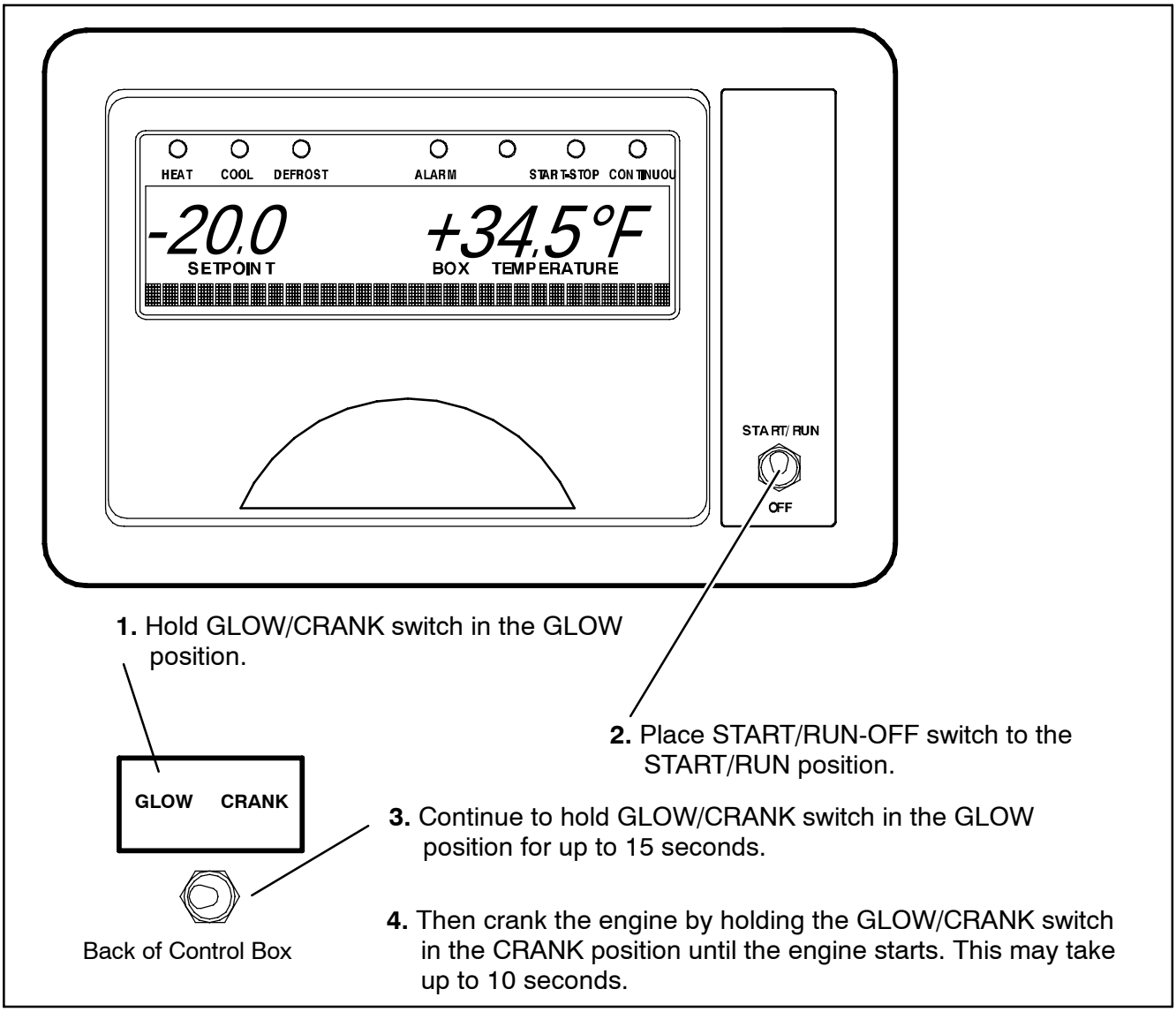
The suction modulation valve (CSMV) will go through a procedure to close itself. The microprocessor starts out giving the CSMV the command to close completely. The display will show
“SMV CLOSING: WAIT XX SECONDS” where xx is the number of seconds until the valve is fully closed. The CSMV will then open to a predetermined position according to the ambient and compartment temperatures. The display will show “SETTING SMV XX%.” The start sequence will start at 30%.

⚠ WARNING

Under no circumstances should ether or any other starting aids be used to start engine.

After the CSMV reaches 30%, the glow plugs will energize (as required), the buzzer will sound, and the diesel engine will start.

3.2 MANUAL START – GLOW AND CRANK – IF EQUIPPED*


HEAT
COOL
DEFROST
ALARM
START-STOP
CONTINUOU
-20.0
SETPOINT
+34.5°F
BOX TEMPERATURE
START/ RUN
OFF
1. Hold GLOW/CRANK switch in the GLOW position.
2. Place START/RUN-OFF switch to the START/RUN position.
GLOW
CRANK
3. Continue to hold GLOW/CRANK switch in the GLOW position for up to 15 seconds.
4. Then crank the engine by holding the GLOW/CRANK switch in the CRANK position until the engine starts. This may take up to 10 seconds.
Back of Control Box

***NOTE**

The GLOW/CRANK switch was removed from units built after April 2007.

When the micro powers up, "MANUAL START MODE SELECTED" will appear in the MessageCenter and the Alarm LED will blink for five seconds.

If the GLOW/CRANK switch is held in the GLOW position before the START/RUN-OFF switch is placed in the START/RUN position, when the START/RUN-OFF switch is in the START/RUN position, the unit Start mode is changed to MANUAL START, and the unit operation mode is set to CONTINUOUS RUN. When the engine is running, this switch is disabled.

⚠ WARNING

Under no circumstances should ether or any other starting aids be used to start engine.

The GLOW/CRANK switch, when held in the GLOW position, tells the microprocessor to energize the glow plug relay, which powers the glow plugs in the engine to preheat the combustion chamber. The CRANK position of the switch tells the microprocessor to engage the engine starter. If the switch is held in the CRANK position, the starter will engage after a short delay of up to one second, for a maximum 10 seconds.

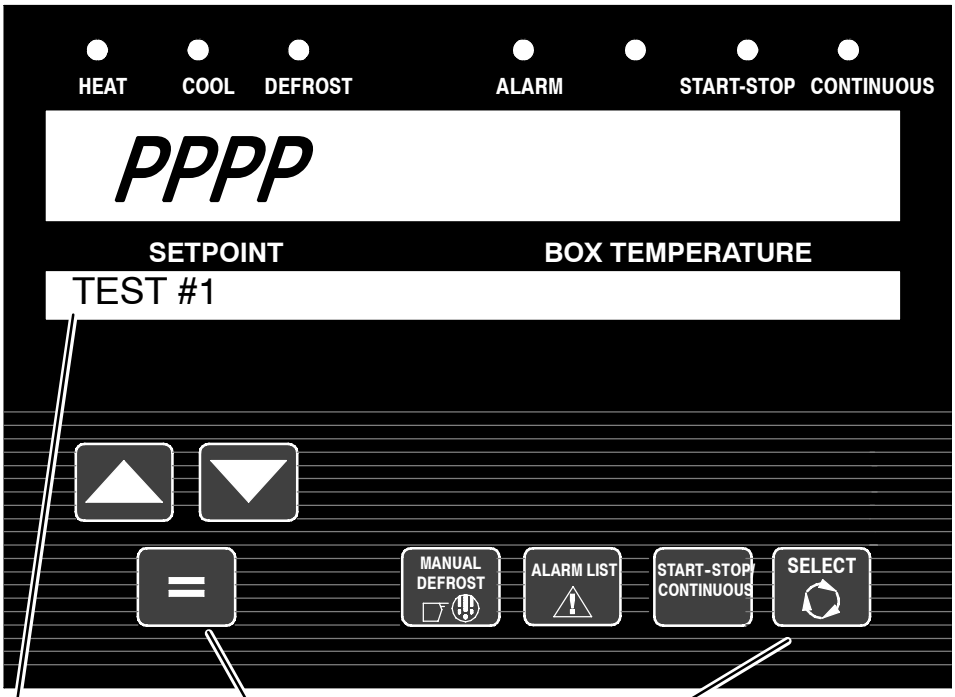
NOTE

Manual Start will automatically put the unit in Continuous Run mode. Placing the unit in Start--Stop will automatically put it back into Auto Start operation.

Manual Start mode will automatically be cancelled when the START/RUN-OFF switch is toggled to OFF and then back to START/RUN.

Refer to Section 4.1.1 for glow times.

3.3 PRETRIP



1. Press the SELECT key until the MessageCenter displays “PRESS THE = KEY TO START PRETRIP.”
2. Press the = key to start PRETRIP.
3. Verify that during TEST#1 the complete display is turned on, that the buzzer comes on and that all lights on the Light Bar come on.
4. The remainder of Pretrip will take 7 to 15 minutes, and will run itself automatically.

The PRETRIP mode is for checking unit operation and evaluating operation of all modes. It will indicate a failure when one is detected.

TIP

A Pretrip can be started with any compartment temperature.

The MessageCenter displays the current test and the % complete of the test. When the Pretrip tests are complete the MessageCenter will display one of three different messages:

- “PRETRIP PASS” or
- “PRETRIP FAIL IN TEST X” or
- “PRETRIP FAILED & COMPLETE”

Press the ALARM LIST key to review the alarms triggered by the Pretrip tests.

TIP

The Pretrip test results message will stay displayed until a key is pressed, or until the START/RUN-OFF switch is moved to the OFF position.

Once Pretrip is started, the control panel keys are disabled until Pretrip is completed.

TIP

If “CAN NOT START PRETRIP” is displayed in the MessageCenter, check to see if the unit is in PC mode (Refer to Section 5.1) or check the alarm list (Section 3.11) for active shutdown alarms.

NOTES

NOTE 1: Pretrip may be initiated any time the unit is running, or when the unit is off but the START/RUN-OFF switch is in the START/RUN position. Pretrip will not start if there is an active shutdown alarm, or if the unit is in PC mode or in defrost.

NOTE 2: Pretrip will run until completed, unless an alarm occurs that causes Pretrip to be aborted. Only alarms that will result in other erroneous alarms or will affect future Pretrip tests will allow Pretrip to be aborted.

TIP

Pretrip may be stopped by the user by either turning the unit off then back on again, or by pressing and holding the = Key for five seconds. "PRETRIP STOPPED BY USER" will appear in the MessageCenter.

Once Pretrip is started: If the unit is running, the micro will shut the unit down by de-energizing the fuel solenoid (non ESC engines) or the fuel and speed actuator (ESC).

If the unit is not running and the suction modulation valve (CSMV) has reached its fully closed position, Pretrip will begin.

TIP

It is always a good idea to clear all alarms from both Alarm Lists before starting Pretrip. This practice allows the technician to know that any alarms present following Pretrip had to occur during Pretrip, and are not old alarms that had simply never been cleared out before.

NOTE

The operator MUST be present and validate this test by watching the micro display during Test 1 – Display Test. The micro will turn on all segments of the LCD and LED display.

Test 1 – Display And Sound Test

The microprocessor activates the LCD/LED display, and all lights on the Light Bar. This test will last five seconds. All segments of the display, all LEDs on the microprocessor, all lights of the Light Bar, and the buzzer will be on during this test. This is the only portion of the Pretrip check that requires the operator to determine PASS or FAIL. A defective display and sound test is indicated if: any LCD/LED segments are not visible, any LEDs or lights do not come on, or the buzzer does not sound. Anything that fails during this test should be repaired at the conclusion of the Pretrip cycle. Pretrip will continue regardless of the outcome of this test. A faulty display, light bar or buzzer will not affect the operation of the unit, but will affect what is displayed during unit operation.

Test 2 – Amperage Check of Electrical Components

Check the amperage (current) draw of the following components:

- Battery DC Current (All Components Turned Off)
- Auto Fresh Air Solenoid
- Auto Fresh Air Solenoid
- Evap/Cond Fan Clutch
- UL1 Front Unloader
- UL2 Rear Unloader
- Speed Solenoid (or ESC module)
- SV1
- SV2
- SV4
- Glow Plugs
- Fuel Solenoid (or ESC module)

Most components will be energized for four seconds at which time the amperage reading is taken. There is a two second rest period between each component. The glow plugs will be energized for 15 seconds, at which time the amperage reading is taken. Test 2 will last approximately two minutes. If a problem is detected with any of the listed components, the corresponding alarm will be displayed.

Test 3 – Temperature and Pressure Sensor Check

Check the condition of the following sensors:

- Return Air Sensor
- Supply Air Sensor
- Engine Coolant Sensor
- Battery Voltage Sensor
- Ambient Air Sensor
- Defrost Termination Sensor
- Compressor Discharge Sensor

Test 3 will last approximately five seconds. If a problem is detected with any of the listed components, the corresponding alarm will be displayed.

PRETRIP (Continued)

Test 4 – Warm Up

The engine is started automatically and the ambient air sensor is read.

The Pretrip splits into two modes at this point as the engine and compressor are allowed to run and be warmed up. If the ambient temperature is above +32°F (0°C), the unit will operate in the "Cool Pretrip" mode. If the ambient temperature is at or below +32°F (0°C), the unit will operate in the "Heat Pretrip" mode.

In the *Cool Pretrip* mode, the unit will operate in two cylinder Low Speed Cool. The compressor suction and discharge pressures will be tested. Appropriate alarms will be displayed if any problem is detected. Test 4 in Cool Pretrip will last approximately 60 seconds.

In the *Heat Pretrip* mode, the unit will operate in four cylinder Low Speed Heat. The micro will check for a rise in compressor discharge pressure, fan clutch operation, and SV1 operation. Appropriate alarms will be displayed if any problem is detected. Test 4 in Heat Pretrip may last up to 12 minutes depending on ambient and compartment temperatures and unit condition. For very low compartment temperature, the unit may operate in six cylinder low speed heat.

Test 5 – UL2 (Rear) Unloader

With the unit still running the same as it was in Test 4, the operation of UL2 Unloader is tested. If suction and discharge pressures do not change when UL2 is energized and de-energized, the "CHECK UL2" alarm will be displayed. Test 5 will last about 20 seconds.

Test 6 – UL1 (Front) Unloader

With the unit still running the same as it was in Test 5, the operation of UL1 is tested. If suction and discharge pressures do not change when UL1, the "CHECK UL1" alarm will be displayed. Test 6 will last about 20 seconds.

Test 7, 8, and 9 – Engine High and Low Speeds

The engine will go from Low Speed to High Speed, then back to Low Speed during these tests. Engine RPM will be checked. If the engine is not operating within the operating range, either the "CHECK LOW SPEED RPM," or "CHECK HIGH SPEED RPM" alarm will be displayed. Tests 7, 8, and 9 will last about 30 seconds.

Test 10 – Check Suction Modulation Valve (CSMV)

This test is to ensure that the CSMV is opening and closing properly. If suction pressure doesn't change as expected with CSMV closed, then "CHECK SMV" alarm will be displayed.

Test 11 – SV1 (Cool Pretrip Only)

With the unit running in two cylinder Low Speed Cool, the operation of SV1 will be tested for opening and closing. If the valve does not operate correctly, the "CHECK SV1 VALVE" alarm will be displayed. This test may last up to three minutes.

Test 12 – Check SV4

NOTE

The Cool and Heat Pretrip modes will merge together at this step.

With the unit running in two cylinder, Low Speed Heat, SV4 is tested for opening and closing. If the valve does not operate correctly, the "CHECK SV4" VALVE alarm will be displayed. This test may last up to eight minutes.

Test 13 – Low Side Pump Down

With the unit running in two cylinder Low Speed, SV2 and SV4 will all be closed to pump the low side of the unit down. If a problem is detected, the alarm "CANNOT PUMP DOWN LOW SIDE" will be displayed. Test 13 may last up to eight minutes.

Test 14 – High to Low Side Leakage

The unit will shut down, and check for pressure equalization between the high and low sides. If any leakage is detected, the HIGH SIDE LEAK alarm will be displayed. This test will last one minute.

Test 15 – Check Discharge Check Valve

With the unit off, the discharge check valve is checked for leakage. If any leakage is detected, the "CHECK DISCHARGE CHECK VALVE" alarm will be displayed. Test 15 will last 40 seconds.

Test 16 – Check for Other Alarms

The alarm list is checked for any non-pretrip alarms that may have occurred during the Pretrip test. If any operational alarms occurred, Pretrip will show FAIL, and the technician will need to review the Alarm List and take necessary and appropriate action to clear them (see list below). Test 16 will last about five seconds.

Test 16 – Check For Other Alarms That May Be Present:

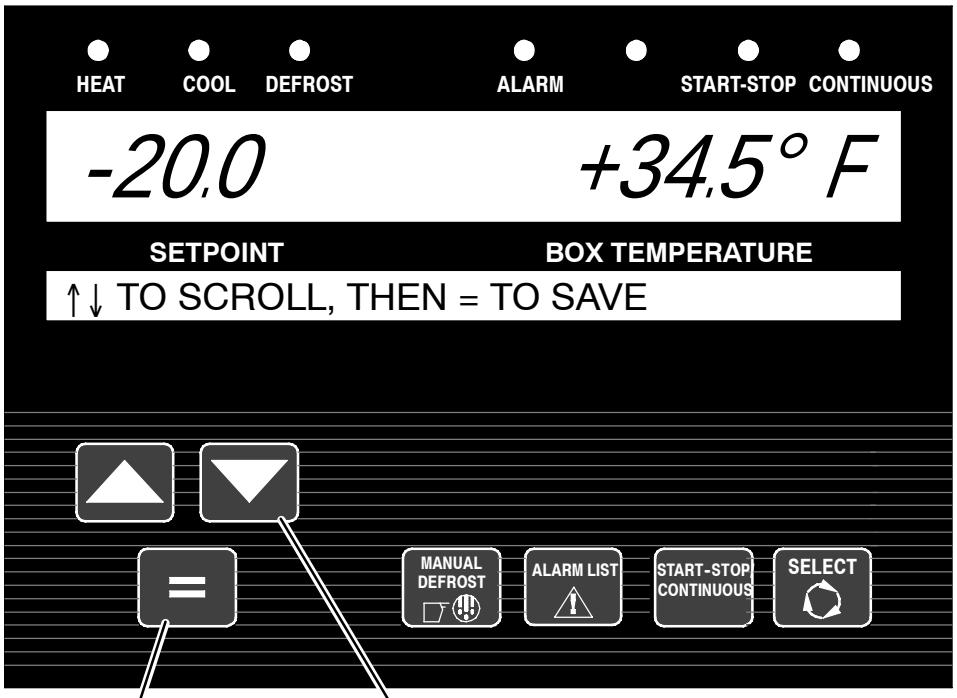
Check for the following alarms:

Alarm No.	Alarm Description
1	LOW FUEL LEVEL WARNING (for units with Low Fuel Level switch/no fuel level display in Data List)
	LOW FUEL LEVEL WARNING (for units with Low Fuel Level 0% to 100% Sensor / fuel level is displayed in Data List)
2	LOW ENGINE OIL LEVEL
3	LOW COOLANT LEVEL
18	LOW REFRIGERANT PRESSURE
27	HIGH SUCTION PRESSURE
28	CHECK REFRIGERATION SYSTEM
34	ENGINE FAILED TO STOP
36	CHECK COOLANT TEMPERATURE
51	ALTERNATOR NOT CHARGING
54	DEFROST NOT COMPLETE
55	CHECK DEFROST AIR SWITCH
59	DATALOGGER NOT RECORDING
60	DATALOGGER TIME WRONG
71	BAD F2 OR F3 FUSE
81	CHECK FHR CIRCUIT
82	CHECK REMOTE OUT-RANGE LIGHT
223 thru 230	If any Maintenance alarms are active, Pretrip will not pass.
232 thru 249	If any Microprocessor alarms are active, Pretrip will not pass.

Pretrip Termination

When the Pretrip cycle is completed, the unit will return to normal temperature control operation.
“PRETRIP PASS” will be shown in the display until the operator presses any key. In the event that the Pretrip test triggered an alarm(s), the display will show either “PRETRIP FAIL and COMPLETE” (if the entire Pretrip cycle was completed), or “PRETRIP FAIL IN TEST——,” (if the Pretrip cycle was aborted by an alarm before it was completed).

3.4 CHANGING SETPOINT



1. With the setpoint displayed, press the UP ARROW or DOWN ARROW key to change the setpoint to the desired value. The MessageCenter will show "↑↓ TO SCROLL, THEN = TO SAVE."

2. Press the = key to save the new setpoint.

Setpoints of -22°F to +89.6° F (-30°C to +32°C) may be entered. The microprocessor always retains the last entered setpoint in memory. The setpoint may be changed up or down one tenth of a degree in 0.1°C or 0.1°F increments, providing "Decimal Displayed" is configured in the configuration list. Refer to the configuration table Section 5.2.1.

NOTE

The microprocessor Configurations allow a minimum and maximum setpoint to be entered, so that only setpoints within that range may be selected. "MAX SETPOINT HAS BEEN REACHED" or "MIN SETPOINT HAS BEEN REACHED" WILL APPEAR in the Message-Center when either of these conditions are met.

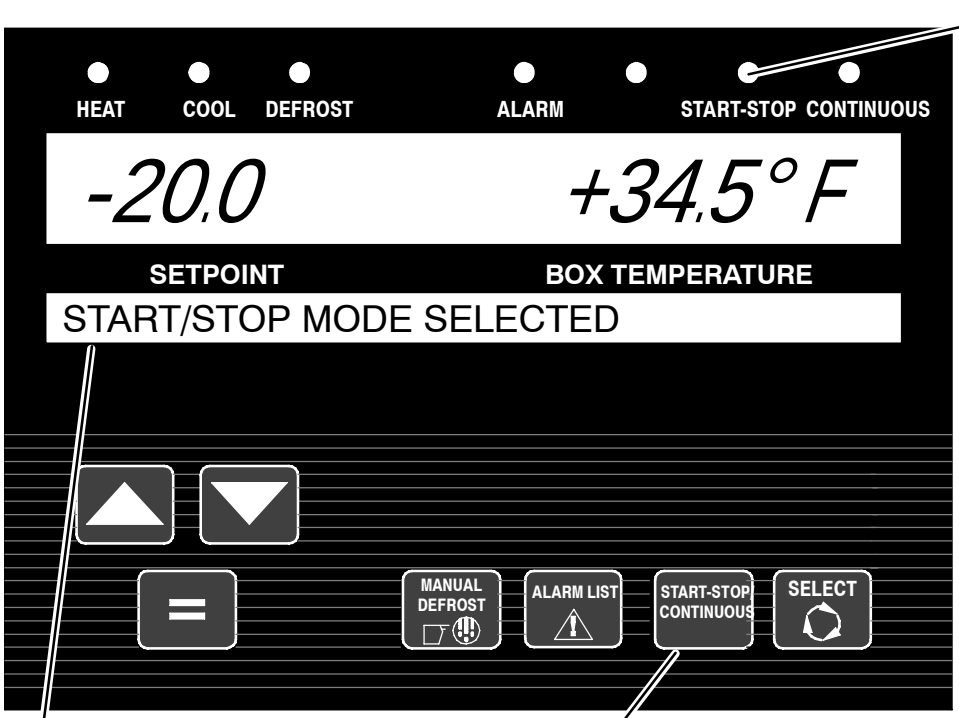
You can not change the setpoint when viewing the Alarm List, Data List or Functional Parameters, or when unit is in Pretrip or is in Sleep mode. Setpoint may be changed any other time the START/RUN-OFF switch is in the START/RUN position, or with the unit in PC Mode.

Pressing the = key will cause the new displayed setpoint value to become active and "SET POINT CHANGED" is displayed. If the display is flashing and the new value is not entered, after five seconds of no keyboard activity, the entire display and Light Bar will flash and the buzzer will sound for 15 seconds with "SET POINT NOT CHANGED" displayed and then revert back to the active setpoint. All other keys are active at this time and if pushed while the display is flashing, will stop the flashing, and perform the requested function.

TIP

You may press and hold the UP ARROW or DOWN ARROW key to quickly change the set-point. The longer the key is held, the faster the setting will change.

3.5 START-STOP OPERATION



1. Press the START-STOP/CONTINUOUS key until the START-STOP Light on the controller illuminates.

2. Verify that "START/STOP MODE SELECTED" is displayed on the MessageCenter and that the Start-Stop light is illuminated. The unit is now in Start-Stop operation.

Automatic Start-Stop gives the microprocessor automatic control of starting and stopping the diesel engine as required. The main function of Automatic Start-Stop is to turn off the refrigeration system near the setpoint to provide a fuel efficient temperature control system and then restart the engine when needed. Refer to Section 4.2 for more detailed information on Start-Stop mode.

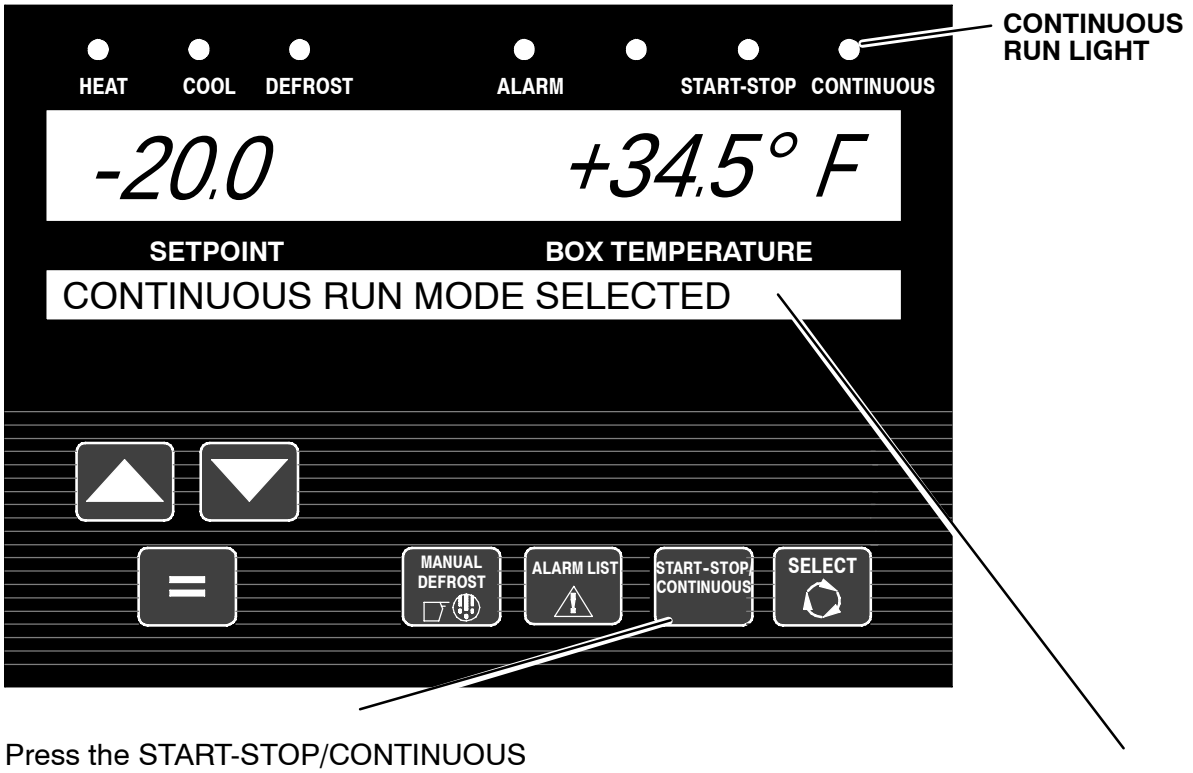
Start-Stop and Continuous operation may be tied to the setpoint ranges for frozen and perishable loads. The START-STOP/CONTINUOUS key is locked out if "START-STOP LOCKED" appears in the MessageCenter when the key is pressed and the unit is in Start-Stop mode or "CONTINUOUS LOCKED" appears in the MessageCenter when the key is pressed and the unit is in Continuous Run mode. Refer to the configuration table Section 5.2.

If the unit fails to start after three start attempts, the "FAILED TO START-AUTO MODE" alarm will be activated. While running, if the unit shuts down on a safety, or fails to run for the minimum run time, three consecutive times, the
"FAILED TO RUN MINIMUM TIME" Alarm will be activated. The shutdown counter is cleared when the unit has run for 15 minutes, or when the unit cycles off normally.

NOTE

FreshProtect is not enabled in Start-Stop mode. See Functional Parameters List – Table 3-3.

3.6 CONTINUOUS RUN OPERATION



1. Press the START-STOP/CONTINUOUS key until the CONTINUOUS RUN Light on the controller illuminates.

2. Verify that "CONTINUOUS RUN MODE SELECTED" is displayed on the MessageCenter and that the CONTINUOUS RUN light is illuminated. The unit is now in Continuous Run operation.

In the Continuous Run mode, the diesel engine will not shut down except for safeties or if the engine stalls. Refer to Section 4.3 for more detailed information on Continuous Run operation.

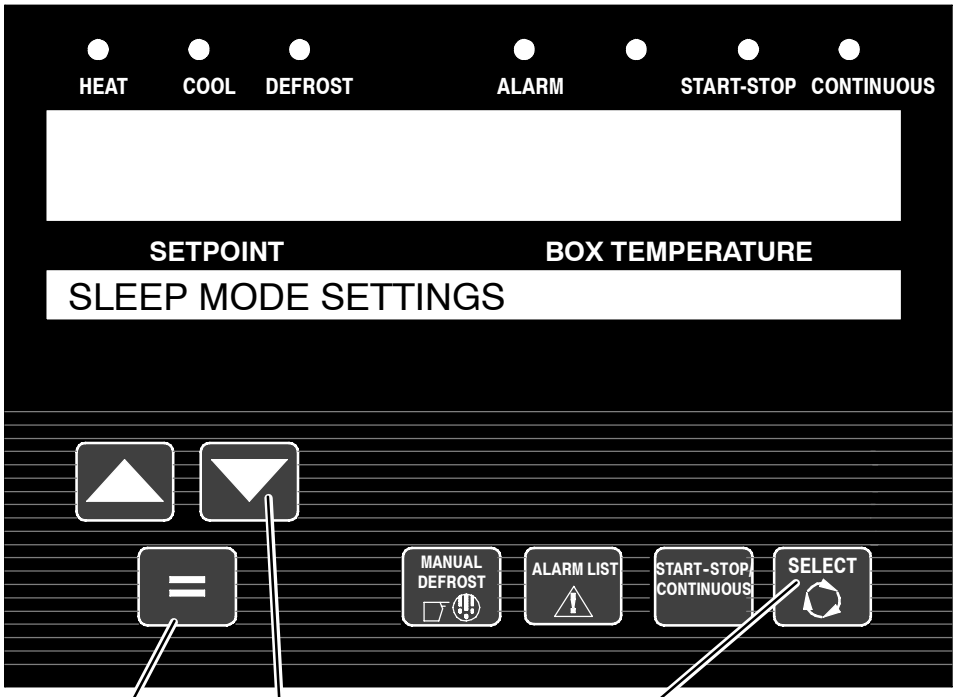
Start-Stop and Continuous operation may be tied to the setpoint ranges for frozen and perishable loads. The START-STOP/CONTINUOUS key is locked out if "START-STOP LOCKED" appears in the MessageCenter when the key is pressed and the unit is in Start-Stop mode or "CONTINUOUS LOCKED" appears in the MessageCenter when the key is pressed and the unit is in Continuous Run mode. Refer to the configuration table Section 5.2.

If the unit fails to start after three start attempts, the "FAILED TO START-AUTO MODE" alarm will be activated. While running, if the unit shuts down on a safety device three consecutive times, without running a minimum of 15 minutes between shutdowns, the "FAILED TO RUN MINIMUM TIME" Alarm will be activated. The shutdown counter is cleared when the unit has run for 15 minutes.

NOTE

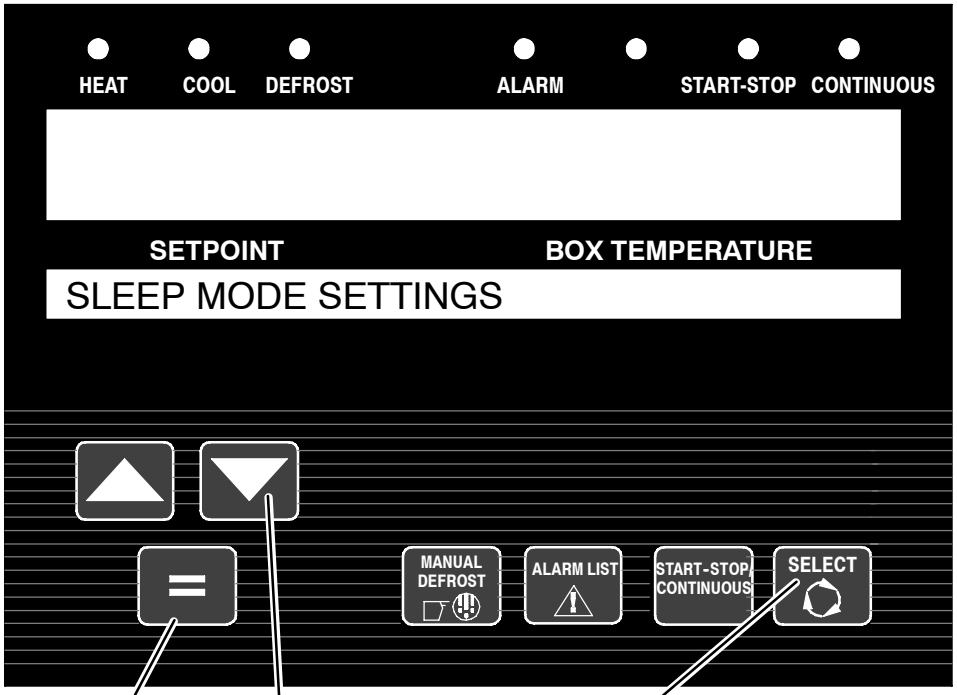
FreshProtect is enabled in Continuous Run mode. See Functional Parameters List – Table 3-3.

3.7 SLEEP MODE ON



1. Press the SELECT key until the MessageCenter displays "PRESS ↑↓ TO VIEW SETTINGS".
2. By pressing the UP or DOWN ARROW key, you will move through the Function List until "SLEEP MODE SETTINGS" appears in the MessageCenter.
3. Press the = key. "↑ ↓ TO SCROLL, THEN = TO SAVE" will show in the MessageCenter.
4. Press the = key to select Sleep Mode Settings.
5. "SLEEP MODE: YES OR NO" will show in the MessageCenter. Press either UP or DOWN ARROW key to change the Sleep Mode to "YES".

3.8 SLEEP MODE OFF



1. Press the SELECT key until the MessageCenter displays "PRESS ↑↓ TO VIEW SETTINGS".
2. By pressing the UP or DOWN ARROW key, you will move through the Function List until "SLEEP MODE SETTINGS" appears in the MessageCenter.
3. Press the = key. "↑ ↓ TO SCROLL, THEN = TO SAVE" will show in the MessageCenter.
4. Press the = key to select Sleep Mode Settings.
5. "SLEEP MODE: YES OR NO" will show in the MessageCenter. Press either the UP or DOWN ARROW key to change the Sleep Mode to "NO".

OR

Sleep Mode OFF

1. To take the unit out of Sleep Mode, place the START/RUN - OFF switch to the OFF position, then back to Start/Run.

SLEEP MODE ON (Continued)

No further menu selections are available when NO is selected from the
"SLEEP MODE: YES OF NO" menu. The following sub menus are available when YES is selected:

1. "WAKE UP TIME"

   a. When "WAKE UP TIME" is set to NO the unit will remain in Sleep Mode until it is taken out manually per Section 3.8

   b. When "WAKE UP TIME" is set to YES the "SET WAKEUP TIME" menu will become available.

Pressing the "=" key will allow the user to select the time the unit is to automatically wake up. The wake up time must be at least 1 hour and no more than 8 days from the time the clock is set. The following information can be entered:

- Month
- Day
- Year
- Hour
- Minute

NOTE

The clock is a 24 hour clock. Hours 1 thru 12 are AM and hours 13 thru 24 are PM.

2. "RUN PRETRIP TEST AT WAKE"

   a. When "PRETRIP TEST AT WAKE" is set to NO the unit will wake up at the designated time and control to setpoint.

   b. When "PRETRIP TEST AT WAKE" is set to YES. the unit will wake up at the designated time, automatically run Pretrip and then control to setpoint. "PRETRIP PASS/FAIL" will remain in the MessageCenter until it is manually cleared.

If Sleep mode is selected when the unit is not running (Start-Stop Off Cycle), any remaining Minimum Off Time will be ignored and the engine will start. It will run for four minutes (minimum), until the engine coolant temperature is above 122°F (50°C), and the battery is fully charged (OK appears in the Data list voltage line, and charging amps are less than amps set in the Configuration list). While the unit is running in Sleep mode, "WARNING: NO TEMP CONTROL" will flash in the MessageCenter, and the main display (setpoint and compartment temperature) will be turned off. This is because compartment temperature does not have to be at setpoint to allow the unit to cycle off (go to sleep).

If the unit is already running when Sleep mode is selected, it will continue to run until the conditions described above are met, then shut off (go to sleep).

There is **NO TEMPERATURE CONTROL** in Sleep mode and it should never be used for hauling perishable or frozen products.

While the unit is cycled off in Sleep mode, "SLEEP MODE, OFF/ON TO WAKE" will be displayed in the MessageCenter. The display backlight will turn off after five minutes. Sleep mode may be exited by either turning the START/RUN-OFF switch to the OFF position, then back to the ON position, or by accessing the Functional Parameter list, and selecting "SLEEP MODE: OFF."

While in Sleep mode, Unit Data and Alarm lists may be viewed, and Functional Parameters may be viewed and changed as necessary. However, Start-Stop /Continuous Run selections, and setpoint can not be changed. Manual Defrost and Pretrip can be initiated.

The unit will restart when engine coolant temperature drops below 34°F (1°C) or if the battery voltage drops below the battery restart value selected in the configurations (See 5.2.1)

Sleep mode is used generally in cold ambients when the trailer or rail car may be parked or not used and the unit is OFF for an extended period of time (one day to several weeks) with no product inside the refrigerated compartment. Many times units are very difficult to start due to a discharged battery, thickened engine oil, etc. after that time in cold ambients. In Sleep mode the unit will "Wake Up" periodically and run to keep the battery charged and the engine warm.

NOTE

In the event that the Engine Coolant Temperature sensor fails, Sleep mode will operate as follows:

In ambients above +32°F (0°C), the unit will run as above, and will monitor battery voltage and charging amps only (according to the configuration setting).

In ambients below +32°F (0°C), the unit will run for 20 minutes minimum run time, then restart every 60 minutes (maximum off time). Battery voltage and amperage will be monitored normally.

NOTE

Units equipped with IntelliSet option can select sleep mode by choosing IntelliSet #31–IntelliSleep. (See Section 3.19.1).

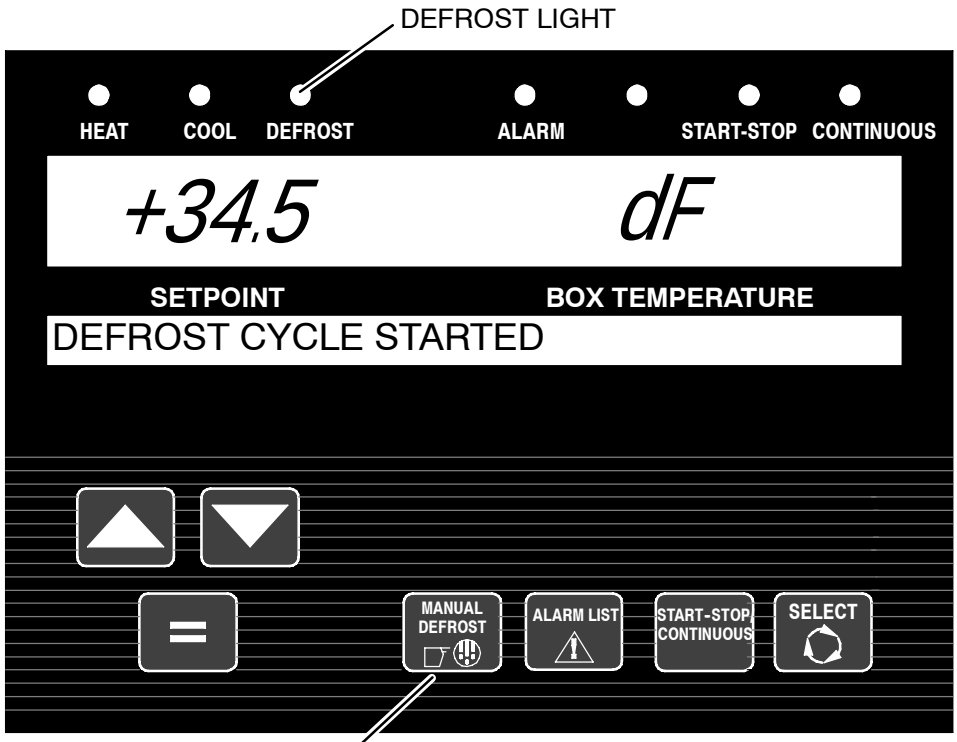
⚠ WARNING

UNITS EQUIPPED WITH STAR-TRAK TWO WAY COMMUNICATION CAPABILITIES MAY HAVE THE ABILITY TO BE STARTED OR TURNED OFF REMOTELY REGARDLESS OF THE SETTING OF THE START/RUN-OFF SWITCH.

The unit is controlled locally and there can be no two-way communication when the Mode switch on the Remote Monitoring Control Box is in MAINTENANCE MODE. Therefore, when performing any work on the unit, place the mode switch in MAINTENANCE MODE. After the unit is serviced, return the mode switch to REMOTE ON. (Refer to Section 3.19.2 for more information on two-way communication.)

3.9 DEFROST

3.9.1 Manual Defrost



1. Press the MANUAL DEFROST key. The DEFROST light will come on and the MessageCenter will display “DEFROST CYCLE STARTED” for five seconds, or flash “CANNOT START DEFROST CYCLE” for five seconds.

DTT2 must be below 40°F (4.4°C) OR SAT must be below 45°F (7.2°C) in order to initiate Manual Defrost. If both the SAT and DTT2 alarms are active, then RAT is used for defrost initiation and it must be below 45°F (7.2°C).

When Defrost mode CANNOT be manually initiated “CANNOT START DEFROST CYCLE” is displayed in the MessageCenter. This will occur when:

- DTT2 is above 40°F (4.4°C), and SAT is above 45°F (7.2°C), OR
- The engine has not run a minimum of15 seconds after starting OR
- The unit is in PC mode OR
- The unit is in Pretrip OR
- There is an active shutdown Alarm.

Check for any of the above conditions, then run the unit to lower the DTT2 temperature to below 40°F (4.4°C) or the SAT temperature to below 45°F (7.2°C) and then restart defrost.

Should the defrost cycle not complete within 45 minutes, the defrost cycle will be terminated and “DEFROST NOT COMPLETE” will be displayed in the MessageCenter. The microprocessor will initiate another Defrost Cycle in 1.5 hours of engine running time. Pressing the manual defrost key will override this mode and start another defrost cycle.

Defrost termination conditions:

- When DTT2 and SAT are above 55°F (12.8°C).
- When a shutdown alarm occurs.
- If the CDT rises to 310°F (154.4°C) for more than a minute when the unit has been in the defrost cycle for more than four minutes.
- If both the DTT2 and SAT sensor alarms are active, the unit will stop defrost after 10 minutes.

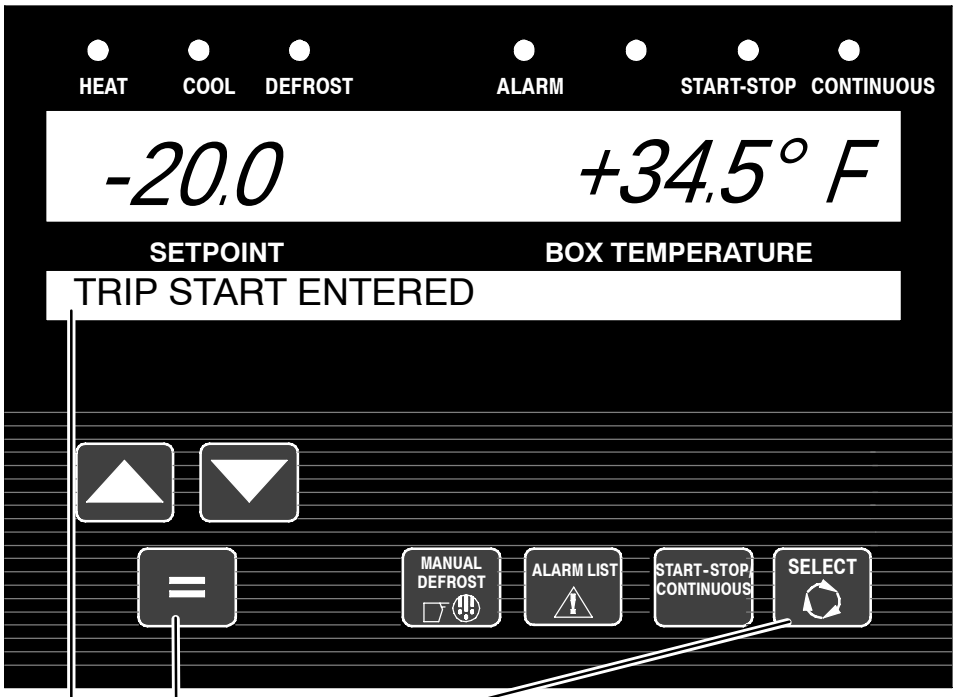
NOTE

Refer to Section 4.4.8 for more detailed information on manual and automatic defrost initiation and termination.

TIP

The Manual Defrost Key can be used at any time to start a Defrost Cycle.

3.10 TRIP START



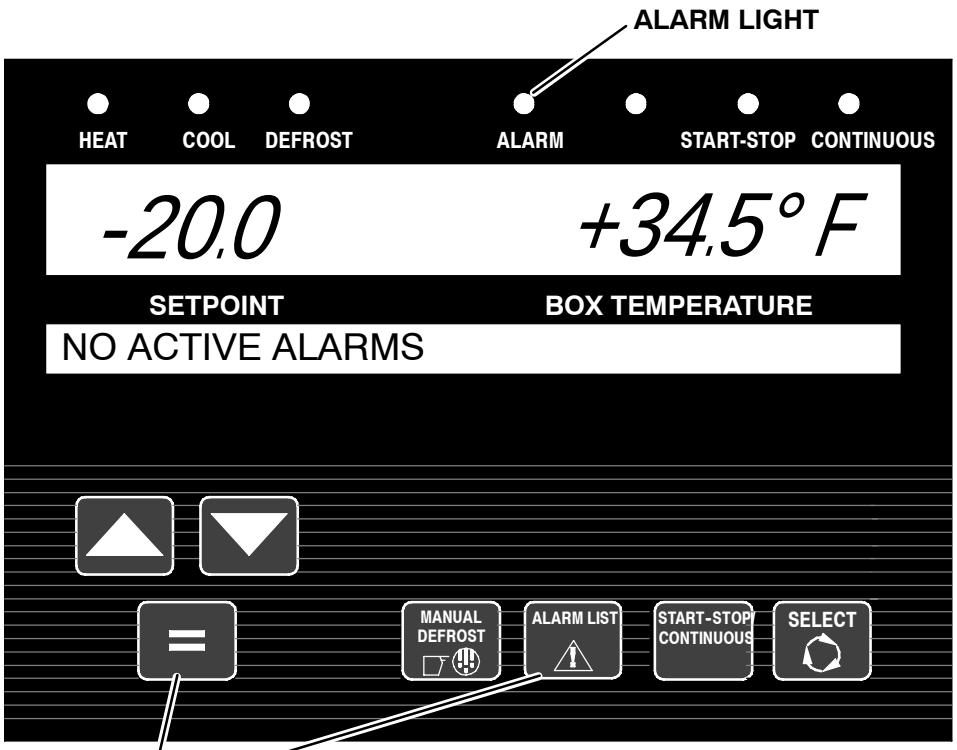
1. To mark the start of a trip in the data recorder, press the SELECT key until The MessageCenter displays “PRESS = TO ENTER TRIP START.”

2. Press the = key.

3. If trip start is acknowledged by the data recorder, “TRIP START ENTERED” will be displayed for five seconds and then the display will revert back to the normal display. Otherwise CANNOT ENTER TRIP START will flash and then the display will revert back to the normal display.

Trip Start places a time stamped events in the data recorder memory to allow easy review of the data from the last trip, and to allow downloading data from a specific trip. A trip begins at a Trip Start, and ends at the next Trip Start. Trip Start tells the data recorder that the present date and time is the beginning of a new trip.

3.11 VIEW ACTIVE ALARMS



1. Press the ALARM LIST key. If there are no active alarms, the display will say “NO ACTIVE ALARMS” for five seconds.
2. If there are active alarms, the display will be ‘A’ and the alarm number and message. The last alarm that occurred will be the first alarm displayed and so on.
3. Press the ALARM LIST or UP ARROW key to scroll through the list of alarms.
4. When you reach the end of the alarm list, “LIST END, = TO CLEAR ALARMS” is displayed for five seconds.
5. To clear the active alarm list, press the = key while “LIST END, = TO CLEAR ALARMS” is being displayed. “ACTIVE ALARMS LIST CLEAR” is displayed. This will move all Alarms to the Inactive Alarm list.

Alarms that occur are stored in the Alarm list in the controller. Stored alarms may be viewed on the MessageCenter.

For a complete list of alarms, their meanings, and troubleshooting refer to Section 7.1.

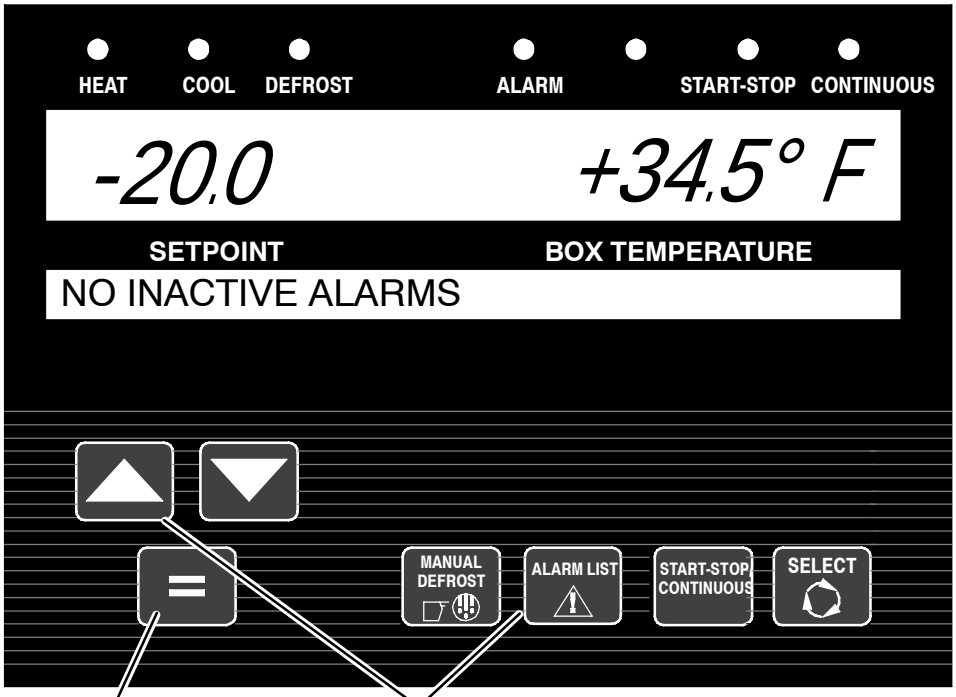
TIP

Another way to clear active alarms is to turn the controller OFF and then back ON using the START/RUN-OFF switch.

TIP

The message “CHECK MICROPROCESSOR” (on earlier microprocessors) or “CHK WIRES FROM MICRO TO KEYPAD” (on newer microprocessors) means there is a wiring problem between the microprocessor and the display module.

3.12 VIEW INACTIVE ALARMS



1. Press and hold both the ALARM LIST key and the UP ARROW key for six seconds. If there are no inactive alarms, the display will say "NO INACTIVE ALARMS" for five seconds.
2. If there are inactive alarms, the display will be 'I' and the alarm number and message.
3. Press the ALARM LIST or UP or DOWN key to scroll through the list of alarms.
4. When you reach the end of the alarm list, "LIST END, = TO CLEAR ALARMS" is displayed for five seconds.
5. To clear the active and inactive alarm list, press the = key while "LIST END, = TO CLEAR ALARMS" is being displayed. "ALL ALARMS CLEAR" is displayed.

The microprocessor can hold up to 16 alarms within the Active and Inactive Alarm Lists combined. The list can be read via the MessageCenter or using the ReeferManager PC program. There are two sections in the Alarm list, an Active Alarm section and Inactive Alarm section. Alarms in these sections are in the order in which the alarms activate and deactivate, respectively. On startup, all alarms are marked as inactive in the entire list. If an inactive alarm becomes active, the alarm is moved from the Inactive Alarm list (section) to the Active Alarm list (section).

As additional alarms occur, they will be placed first in the Active Alarm list. An alarm can not be active and inactive at the same time. Each alarm can only be present in either the Active or Inactive Alarm list at any given time. As conditions changed, alarms may be moved from the Active Alarm list to the Inactive alarm list and back.

Alarms are also recorded in the data recorder. They are recorded at the time they occur (become active), and the time they become inactive.

For a complete list of alarms and troubleshooting information refer to Section 7.1.

TIP

When alarms are cleared from the Inactive Alarm list, both active and inactive alarm lists are cleared.

If there is a safety shutdown, **UNIT SHUTDOWN - SEE ALARM LIST** will be shown. Pressing the Alarm List key will bring any Active Alarms into the MessageCenter.

NOTE

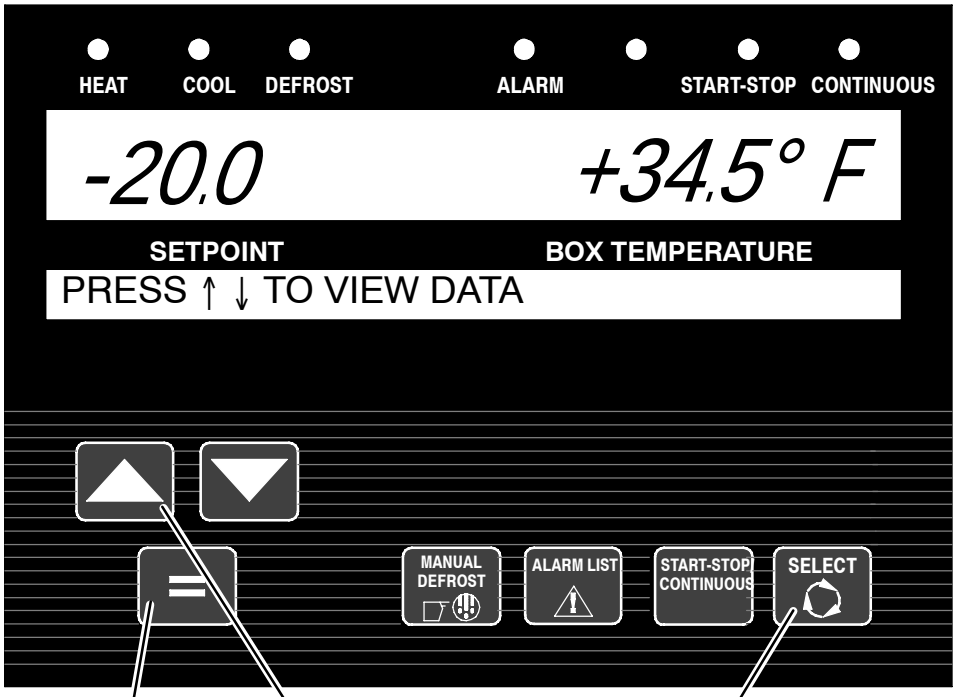
The Inactive Alarm List is also called the Technicians List. Only qualified refrigeration technicians should access the inactive list. It is not intended for the use of drivers or operators.

Table 3-1. Shutdown Alarms

SHUTDOWN ALARMS			
		SHUTDOWN	**ALARM ONLY** or may be configured as SHUTDOWN (see configuration list Section 5.2.1)
2	Low Oil Level		**X**
11	Low Engine Oil Pressure	**X**	
12	High Coolant Temperature	**X**	
13	High Discharge Pressure	**X**	
15	Battery Voltage Too High	**X**	
16	Battery Voltage Too Low	**X**	
17	High Comp Discharge Temp	**X**	
18	Low Refrigerant Pressure		**X**
19	Low Fuel Shutdown		**X**
20	Maximum Compressor Alarms (Optional)	**X**	
27	High Suction Pressure		**X**
28	Check Refrigeration System		**X**
29	Check Heat Cycle	**X**	
30	Failed To Run Minimum Time	**X**	
31	Failed to Start – Auto Mode	**X**	
32	Failed to Start – Manual	**X**	
35	Check Starter Circuit	**X**	
39	Check Engine RPM		**X**
41	Engine Stalled	**X**	
51	Alternator Not Charging		**X**
53	Compartment Temp Out-of-Range		**X**
56	Check Evaporator Airflow	**X**	
57	Check Remote Switch 1		**X**
58	Check Remote Switch 2		**X**
61	Door Open		**X**
72	Bad F4 or F6 Fuse	**X**	
♦122	Check Return Air Sensor	♦	
♦123	Check Supply Air Sensor	♦	
204	Low Suction Pressure	**X**	
232	Setpoint Error	**X**	
233	Model # Error	**X**	
237	Function Parameter Error	**X**	
238	Configurations 1 Error	**X**	
242	DIS PRESS Calibrate Error	**X**	
243	SUCT/EVAP Calibrate Error	**X**	
246	EEPROM Write Failure	**X**	
248	Config Mode/HP2 Error	**X**	
249	Microprocessor Error	**X**	

♦If Alarms 122 and 123 are both active and setpoint is in the perishable range [10.4°F(-12°C)] and higher – the unit will shut down. Otherwise, alarm only.

3.13 UNIT DATA



1. Press the SELECT key until the MessageCenter displays “PRESS ↑↓ TO VIEW DATA.”

2. By pressing the UP ARROW key, you will move through the Data List beginning at the top and moving toward the bottom, or by pressing the DOWN ARROW key, you will move through the Data List beginning at the bottom, and moving toward the top.

3. The selected Data Item will remain in the MessageCenter for 10 seconds, then the default message (STATUS OK or other customer specified message) will appear.

4. To lock an item in the MessageCenter for continuous viewing, press the = key. The Data item will flash continuously to indicate it is locked.

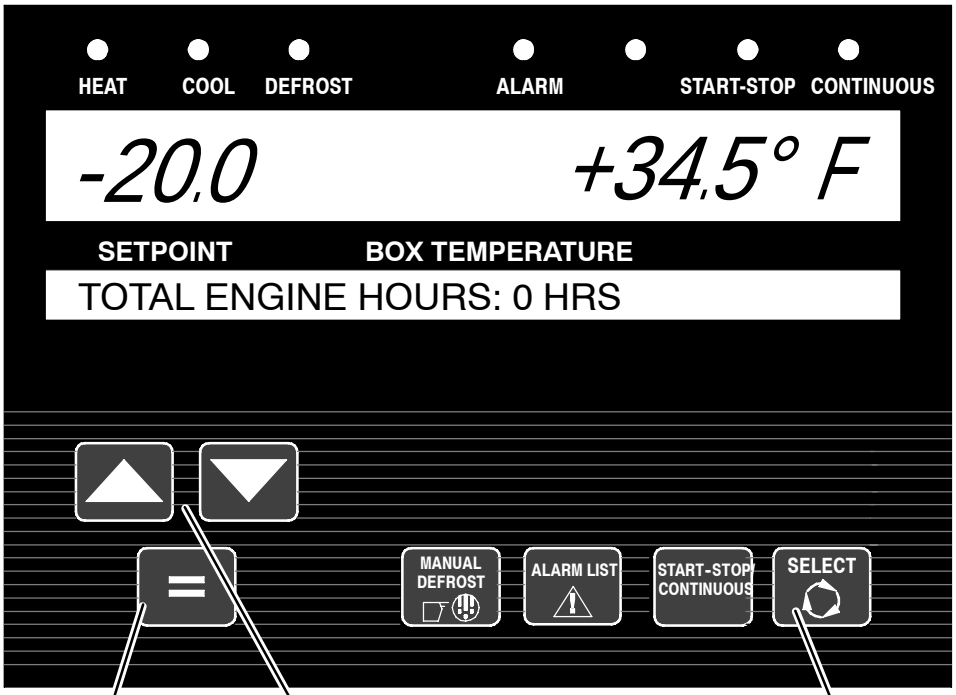
5. Pressing UP or DOWN key will unlock that item and move to the next data item. Pressing the = key will unlock the item, and after 10 seconds the default message will be displayed.

Table 3-2. UNIT DATA		
* Also appear in Configurations		
+ May or may not be displayed depending on functional parameter settings		
	SUCTION PRESSURE	Compressor suction pressure
	DISCHARGE PRESSURE	Compressor discharge pressure
	ENGINE COOLANT TEMP	Engine coolant temperature
	RETURN AIR TEMP	Return (air entering evaporator) air temperature
	SUPPLY AIR TEMP	Supply (air leaving evaporator) air temperature
	DELTA-T	Supply air temperature minus Return air temperature.
	AMBIENT AIR TEMP	Ambient (air entering condenser) air temperature
	DEFROST TERM TEMP 2	Defrost termination temperature (Located on the center evaporator tube sheet)
	DISCHARGE TEMP	Compressor discharge temperature
	BATTERY	Battery voltage
	CURRENT DRAW	Battery charging or discharging amps.
	ENGINE RPM	Engine revolutions per minute
	FUEL LEVEL	% of fuel in tank. (This is only shown when 0%-100% sensor is configured ON.)
	SUCTION MOD VALVE	% open of CSMV
	START MODE	AUTO if the engine will start automatically MANUAL if the engine must be started manually
	INSTALLED OPTIONS INTELLISET INSTALLED DATATRAK INSTALLED COMPRESSOR ALARM SHUTDOWN	Applies only if unit has any one or more of these options installed.
	SOFTWARE REVISION	Revision of the software that is operating the microprocessor
	DISPLAY SOFTWARE REV	Revision of the software that is operating the display
	CONTROL SERIAL #	Serial Number of the microprocessor
*	ID #	ID (as entered by the user) – Trailer, Car or Asset ID
*	UNIT SERIAL #	Unit serial number
*	UNIT MODEL #	Unit model number (selected through configurations)
+	HOURS TO ENGINE MAINT	Number of engine hours until the next programmed engine maintenance.

Table 3-2. UNIT DATA		
* Also appear in Configurations		
+ May or may not be displayed depending on functional parameter settings		
+	HOURS TO UNIT MAINT	Number of switch-on hours until the next programmed general unit maintenance.
+	TIME LEFT TO PM (1-5)	Number of hours until the next programmed maintenance.
*	PRODUCTSHIELD SETUP:	Indicates that unit has IntelliSet installed and displays ProductShield settings.
	PRODUCTSHIELD ECONO:	Indicates if ProductShield Econo is **OFF** OR **Go To Start-Stop** OR **Go To Continuous Run**
	ECONO MIN TEMP	Minimum ambient temperature of range for activation of ProductShield Econo (Will only be displayed if Econo is **NOT OFF**)
	ECONO MAX TEMP	Maximum ambient temperature of range for activation of ProductShield Econo (Will only be displayed if Econo is **NOT OFF**)
	ECONO DELTA-T	Delta-T value for activation of ProductShield Econo (Will only be displayed if Econo is **NOT OFF**)
	PRODUCTSHIELD HIGH AIR:	Indicates if Product Shield High Air is **ON** or **OFF**
	HIGH AIR MIN TEMP	Minimum ambient temperature of range for activation of Product Shield High Air (Will only be displayed if High Air is **ON**)
	HIGH AIR MAX TEMP	Maximum ambient temperature of range for activation of Product Shield High Air (Will only be displayed if High Air is **ON**)
	HIGH AIR DELTA-T	Delta-T value for activation of Product Shield High Air (Will only be displayed if High Air is **ON**)
	PRODUCTSHIELD: WINTER - xx°	Indicates the ambient temperature below which ProductShield Winter will operate. (Will only be displayed if WINTER is **NOT OFF**)
* +	RANGE 1 LOCK	OFF – Temperature Range 1 Lock is turned off. CONTINUOUS – When the setpoint is set between Range 1 Minimum and Maximum Temperatures, the unit is set to operate only in Continuous Run. START-STOP – When the setpoint is set between Range 1 Minimum and Maximum Temperatures, the unit is set to operate only in Start-Stop.
* +	RANGE 1 MINIMUM TEMP	This is the lower limit for Range 1.
* +	RANGE 1 MAXIMUM TEMP	This is the upper limit for Range 1.
* +	RANGE 2 LOCK	OFF – Temperature Range 2 Lock is turned off. CONTINUOUS – When the setpoint is set between Range 2 Minimum and Maximum Temperatures, the unit is set to operate only in Continuous Run. START-STOP – When the setpoint is set between Range 2 Minimum and Maximum Temperatures, the unit is set to operate only in Start-Stop.
* +	RANGE 2 MIN. TEMP	This is the lower limit for Range 2.
* +	RANGE 2 MAX. TEMP	This is the upper limit for Range 2.

Table 3-2. UNIT DATA		
* Also appear in Configurations		
+ May or may not be displayed depending on functional parameter settings		
* +	REMOTE SENSOR (1-3)	This is the temperature at remote Temperature Sensor 1, 2, and 3. (These sensors are optional, and may not be applicable to your unit. Up to three remote sensors may be listed.)
*	DATALOGGER	This is the current Date and Time that the DataRecorder is using. This may be different than your actual time, depending on the Time Zone and Daylight Savings Time selections made by the owner of the unit.

3.14 VIEW HOURMETERS



1. Press the SELECT key until the MessageCenter displays "PRESS ↑↓ TO VIEW HOURMETERS."

2. Press the UP or DOWN ARROW key to move through the Hourmeter List.

3. Displayed hourmeters will depend on unit configurations (See Section 5.2.1). Typical displayed meters are: "TOTAL ENGINE HOURS" and "TOTAL SWITCH ON HOURS."

4. Pressing the = key will access all other meters when "OTHER METERS AND COUNTERS" is displayed.

5. The selected hourmeter will remain in the MessageCenter for 10 seconds and then the default message (STATUS OK or other customer specified message) will appear.

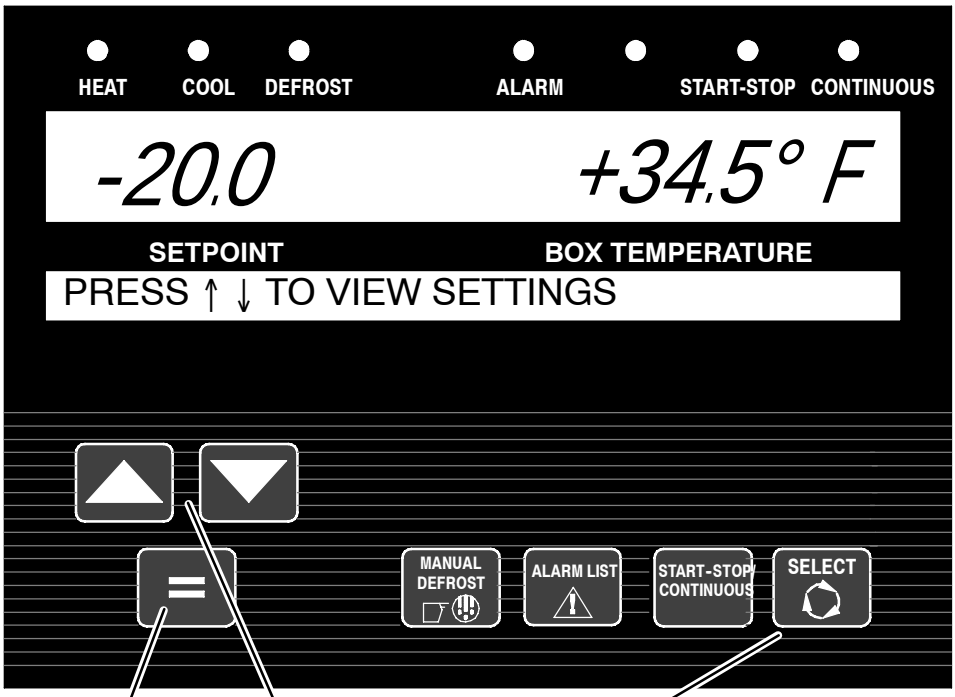
6. To lock an hourmeter in the MessageCenter for continuous viewing, press the = key. The hourmeter will flash continuously to indicate it is locked.

7. Pressing any key on the keypad will unlock the item. Pressing the UP or DOWN ARROW key will move to the next hourmeter.

Hourmeters available when "OTHER METERS AND COUNTERS" is chosen are:

- Meters listed in Step 3 above that were not previously displayed.
- Engine Protect Hours
- Switch On Protect Hours
- Engine Sleep Hours
- High Speed Hours
- Clutch Cycles
- Start Cycles

3.15 FUNCTIONAL CHANGE (PARAMETERS)



1. Press the SELECT key until the MessageCenter displays "PRESS ↑↓ TO VIEW SETTINGS."
2. By pressing the UP ARROW key, you will move through the Function List beginning at the top or by pressing the DOWN ARROW key, you will move through the Function List beginning at the bottom.
3. To change one of the functions, bring the function you wish to change into the MessageCenter, and press = key. "↑ ↓ TO SCROLL, THEN = TO SAVE" will show in the MessageCenter. Pressing either UP or DOWN ARROW key will begin to change the function setting. The MessageCenter will flash, indicating that a change has been made that has not been entered into memory.
4. Continue pressing UP or DOWN ARROW key until the desired value is showing, then press the = key. The MessageCenter will stop flashing. The new value is now in memory. If the = key is not pressed within 10 seconds, the MessageCenter will change to "FUNCTION NOT CHANGED." This will appear for five seconds, then return to the last Functional Parameter shown. If no further keys are pressed, the default message will be displayed after10 seconds.

NOTE

Any function that is shown with a padlock symbol cannot be changed from the keypad.

Table 3-3. Functional Parameters

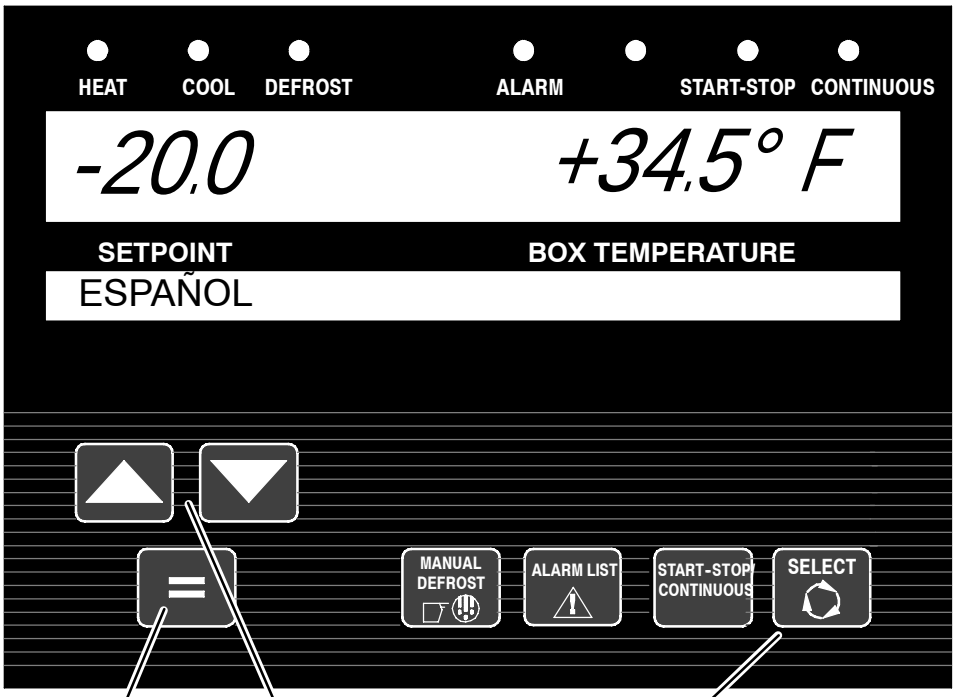
FUNCTIONAL PARAMETER	SELECTIONS	DESCRIPTION
DEFROST TIMER SET FOR	1.5HRS 3HRS **6HRS** 12HRS	The defrost timer will automatically put the unit into the defrost cycle at the interval selected. If evaporator is below 40°F (4.4°C). Shorter times are generally used for warm, humid products like produce. Longer times can be used for dry and frozen products.
SET S/S PARAMETERS (These may be displayed individually (8 parameters) as PERISH and FROZEN, or combined (4 parameters) with no designation.)		Time and Temperature values that control the Automatic Start-Stop operation are set in this section.
• (PERISH / FROZEN) MIN RUN TIME:	**4MINS** TO 60MINS (in one minute increments)	This determines the minimum length of time the unit will run every time the unit starts in Auto Start-Stop modes.
• (PERISH / FROZEN) MIN OFF TIME:	10MINS TO 90MINS **20MINS** (in one minute increments)	This determines the minimum length of time the unit will remain off whenever the unit cycles off in Auto Start-Stop modes.
• (PERISH / FROZEN) OVERRIDE TEMP:	3.6°F (2°C) TO 18°F (10°C) **11°F (6°C)** (in 0.5°F or C increments)	This selects the override restart temperature for the Auto Start-Stop Off Cycle. During the Minimum Off Time, should the refrigerated compartment temperature drift this far above or below setpoint in the Perishable Range, or above setpoint in the Frozen Range, the unit will override the Minimum Off Time, and restart.
• (PERISH / FROZEN) MAX OFF TIME:	**OFF** 10MINS TO 255MINS (in one minute increments)	OFF – There is no maximum off time. When a minute value is selected, this is the longest amount of time the unit will remain off during a (Perishable or Frozen or both) Auto Start--Stop Off Cycle. When this time expires, the unit will restart and run for the Minimum Run Time, regardless of any temperature change inside the compartment.
FROZEN SHUT-DOWN OFFSET	**0°F (0°C)** TO 3.6°F (2°C)	This only applies to Frozen Setpoints in Start-Stop operation. This offset is the number of degrees below setpoint that the unit will run before cycling off. This will allow for a lower average compartment temperature when considering temperature rises during off cycles.
TEMP CONTROL:	**RETURN AIR** / SUPPLY AIR	The unit has both a Return Air Sensor and a Supply Air Sensor. This selection determines which sensor temperature will be used for setpoint selections above 10.4°F (-12°C) to determine when setpoint is reached. Return Air is generally selected for most products. Products that are sensitive to small temperature changes may use the Supply Air setting. Supply Air limits the temperature of the air leaving the evaporator to the setpoint setting. NOTE: Whenever the setpoint is below +10.4°F(-12°C), the unit will ALWAYS be controlled by the Return Air Sensor, regardless of the selection made here.

FUNCTIONAL PARAMETER	SELECTIONS	DESCRIPTION
DISPLAY IN	**ENGLISH UNITS** METRIC UNITS	The display will show temperatures and pressures in either English (°F and PSIG) or Metric (°C and Bars)
*RESET PM HOURMETERS		Maintenance hourmeters that have expired will appear in this list.
• ENGINE • SWITCH ON • PM 1 Thru 5	RESET	If there are no active maintenance hourmeters, this menu item will not appear in the Functional Parameters. If there are active maintenance hourmeters and none have expired and turned the alarm on, the MessageCenter will display "NO HOURMETERS TO RESET." When any maintenance hourmeter has timed out, and preventative maintenance has been performed, selecting RESET and pressing the = key will de-activate the alarm, and reset the hourmeter for the next service interval.
OUT OF RANGE ALARM:	English Metric OFF OFF 4°F 2°C 5°F 3°C **7°F 4°C**	Once the unit is at setpoint, then drifted away for more than 15 minutes, an Out-Of-Range Alarm will come on. (Or, if configured for Out Of Range Shutdown, after 45 minutes the unit will shut down.) This setting determines how far away from setpoint the temperature must move before the timer is started. 4°F may be used for very critical temperature products, 7°F may be used for less critical products. The alarm may be turned off by selecting the OFF setting.
AIR FLOW	**NORMAL** HIGH	The NORMAL selection allows the unit to cycle from High Speed to Low Speed, depending on how close the compartment temperature is to setpoint. Some products generate a considerable amount of heat (heat of respiration) during transportation. This frequently occurs with produce. The HIGH selection can be used for these loads, since continuous high air flow may be required to keep the entire load at a constant temperature. The engine will remain in High Speed when High is selected. **NOTE:** HIGH AIR FLOW does not work with setpoints below +10.4°F (-12.0°C).
FRESH PROTECT	**OFF** A = 2 TO 5°F (1.1 TO 2.8°C) B = 4 TO 7°F (2.2 TO 3.9°C) C = 6 to 9°F (3.3 TO 5.0° C) D = 8 to 11°F (4.4 TO 6.1 ° C) E = 10 to 13°F (5.6 TO 7.2° C)	OFF - Fresh Protect is turned off A thru E determines the allowable temperature SAT can go below setpoint when the unit is operating in Continuous Run Cool. FreshProtect does not operate in Start-Stop. (See Section 4.5.4.)
AUTO FRESH AIR	**0 = CLOSED** 1 = OPEN 2 = CFM CONTROL	**CLOSED** - AutoFresh Air Exchange assembly will be closed except for pretrip and component test mode. OPEN - Assembly will be open if the engine is running and the setpoint is greater than 28°F (-2.2°C) and the unit is not defrosting CFM CONTROL - Assembly will be cycled open and closed over a 20 minute time period. The length of time the assembly is opened or closed is based on the Auto Fresh Air Control Functional Parameter. The CFM CONTROL will only be active for setpoints greater than 28°F (-2.2°C) and in Continuous Run mode or Auto Start-Stop mode when the engine is running. The assembly will be closed when the setpoint is less than 28°F (-2.2°C) or during defrost or during the off cycle of Start-Stop mode.
AUTO FRESH AIR CONTROL	5 TO 50 CFM IN 5 CFM INCREMENT**S** **25 CFM**	When CFM CONTROL is selected, this parameter is visible. When CFM CONTROL is used, the solenoid will open and close in 20-minute time blocks to control the amount of air being exchanged, so that the amount of air exchanged averages the CFM setting. During the first portion of the 20-minute block, the solenoid will be open, allowing fresh air in and exhausting stale air. Once sufficient air has been exchanged, the solenoid will close until the beginning of the next 20-minute block.

FUNCTIONAL PARAMETER	SELECTIONS	DESCRIPTION
LOW SPEED START-UP MINUTES		Allows user to set the number of minutes the unit will run in low speed every time the engine starts.
–CONTINUOUS:	**OFF** or 1 to 255 minutes	
–START-STOP	OFF or 1 to 255 minutes (**10 min**)	
UNLOADER PRESSURE CONTROL	**Std** -5 +5	The recommended setting for this is Std. This setting should not be changed unless discussed with a Carrier Transicold Factory Service Engineer or Field Service Engineer.
SLEEP MODE SETTINGS The following sub menus determine whether sleep mode is to be used and what the settings will be.		
• SLEEP MODE The following two sub menu selections will be available if YES is selected.	**NO** YES	NO – is the normal operating selection and no further selections will be available. YES– selects Sleep Mode. In this mode the unit will operate only as needed to keep the engine warm, and the battery charged. There is NO TEMPERATURE CONTROL in Sleep Mode.
The following Sleep Mode parameters were added in Software Version 04.07.00		
• WAKE UP TIME	**NO** YES	NO – the unit will remain in Sleep Mode until it is taken out manually. This can be accomplished either through the Functional Parameter list or by turning the Run/Stop switch to STOP and then back to RUN. YES– the SET WAKE UP TIME sub menu will be available
SET WAKE UP TIME		This setting is used to set Sleep Mode wake up time. The clock is a 24 hour clock. Hours 1 thru 12 are AM and 13 thru 24 are PM. The wake up time must be at least 1 hour and no more than 8 days from the time the clock is set
• MONTH	1–12	Select the correct month of the year.
•DAY	1–31	Select the correct day of the month.
•YEAR	1998 – 2037	Select the correct year.
•HOURS	0–23	Select the correct hour (0–11 is AM / 12–23 is PM)
•MINUTES	0–59	Select the correct minute.

FUNCTIONAL PARAMETER	SELECTIONS	DESCRIPTION
• RUN PRETRIP AT WAKE	**NO** YES	NO – The unit will wake up at the designated time and control to setpoint. YES – The unit will wake up at the designated time, automatically run Pretrip and then control to setpoint. The Pretrip Pass/Fail message will remain in the MessageCenter until the message is manually cleared.
* OVERRIDE DOOR SHUTDOWN	**NO** YES	This will only appear when a compartment door switch is configured "ON" in the Configuration List. NO – Allows the door switch to shut the unit down whenever the compartment door is opened and the door switch is configured for shutdown. YES – Allows operator to over-ride the compartment door shutdown switch, and allow the unit to continue to run, even with the compartment door open.
* OVERRIDE REMS (1-2) SHUTDOWN	**NO** YES	NOTE: This will only appear when a remote switch (REMS1 or REMS2) is configured "ON" in the Configuration List. NO – Allows remote switch (1 and/or 2) to shut the unit down whenever door is open or the switch is turned ON. YES – Allows operator to override remote switch (1 and/or 2), and allow the unit to continue to run, even with the remote switch in the ON position or the door is open.
LANGUAGE / IDIOMAS: LANGUE: LINGUAGEM:	**ENGLISH** ESPAÑOL FRANÇAIS PORTUGUÊS	ENGLISH – All information displayed in the MessageCenter will be shown in English. FRANÇAIS – All information displayed in the MessageCenter will be shown in French. ESPAÑOL– All information displayed in the MessageCenter will be shown in Spanish. PORTUGUÊS – All information displayed in the MessageCenter will be shown in Portuguese. **NOTE:** This parameter can be quickly accessed by pressing and holding the Select key for six seconds.
Selections in **BOLD** are the factory settings.		
* This Functional Parameter may not appear in the list for your unit, depending on how the microprocessor has been configured.		

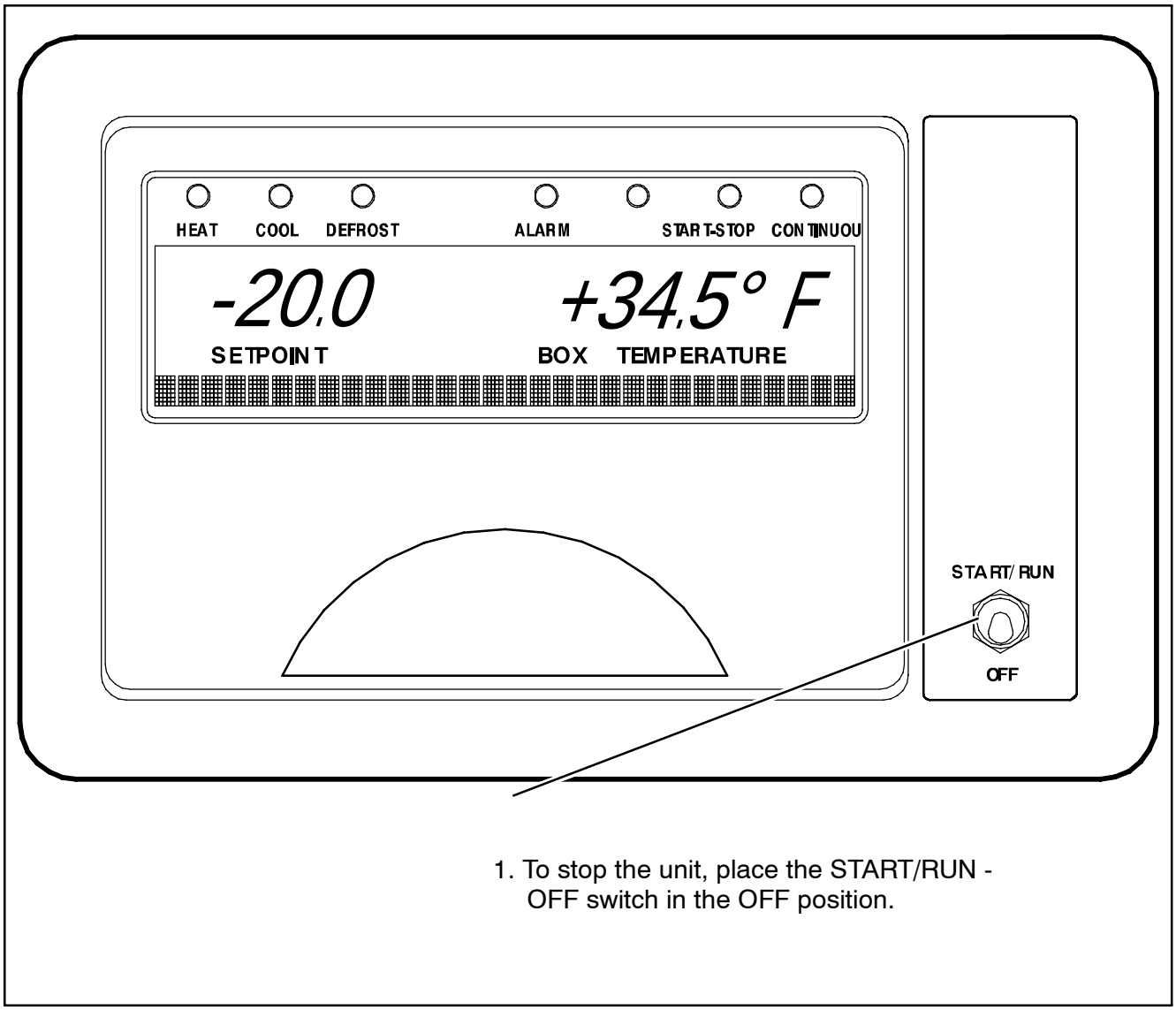
3.16 LANGUAGE SELECTION



1. Press and hold the SELECT key for six seconds until MessageCenter displays current language (ENGLISH, ESPAÑOL, FRANÇAIS or PORTUGUÊS).

2. Press the UP or DOWN ARROW key until the MessageCenter indicates the desired language. Press the = key. The new language will now be active.
If the = key is not pressed within 10 seconds, the MessageCenter will change to “FUNCTION NOT CHANGED.” This will flash for five seconds, then return to the current language. If no further keys are pressed, the default display will return in another 10 seconds.

3.17 STOPPING UNIT



1. To stop the unit, place the START/RUN - OFF switch in the OFF position.

The diesel engine will stop and the microprocessor controller will turn off. The Microprocessor Main Display, MessageCenter, and all indicator LEDs will also turn off.

NOTE

Due to internal processing within the microprocessor, turning the START/RUN-OFF switch OFF then back to START/RUN will result in a 4 to 50 second delay between the display going off and coming back on again.

NOTE

The CSMV will close to 0% when START/-RUN-OFF switch is switched to OFF.

3.18 DATA RECORDING

The Advance microprocessor contains a built-in DataRecorder with 512K of memory. The recorded data can be downloaded from the DataRecorder using either ReeferManager, a PC software program, or a Download PC card.

The DataRecorder reads the same input information as the microprocessor (Functional Parameters, Configurations, and Unit Data) at all times. The DataRecorder records events as they occur, such as setpoint changes and Defrost Initiation and Termination, and also records all data values including temperature and pressure sensors in either averaged or snapshot format. The details are provided below.

3.18.1 Microprocessor Information

The microprocessor Information that is available to be recorded is as follows:

- DataRecorder Setup Sensor Being Recorded (Logging Intervals, Events and Sensors)
- DataRecorder Time Clock Date / Time
- Setpoints (And all setpoint changes.)
- ID Number
- Unit Serial Number
- Unit Model Number
- Current System Mode
- Functional Parameters
- Controller Configurations

3.18.2 Data Recording

The DataRecorder data comes from four general categories of information:

a. Microprocessor Information as described in Section 3.18.1 above.

b.Sensor Data

This information is recorded at predetermined intervals as a snapshot of the sensor at the time of the recording, or an averaged reading of the sensor readings since the last recording. The user can determine which sensor(s) will be recorded, at what interval, and whether snapshot or averaged readings are preferred. Snapshot readings of sensors are also taken at the time of a shutdown alarm.

c.Event Occurrences

This information is any additional data that is recorded on a “when it occurs” basis. Events are recorded by the recorder as they occur. An Event is defined as something that happens (i.e. setpoint changed, Defrost Cycle Started, or Main Power On, etc.).

d.User Area Data

The user or service technician is able to enter a comment into the DataRecorder using the ReeferManager program.

3.18.3 Sensor and Event Data

Sensors

The following sensors may be recorded either with an averaged reading, or snapshot.

- Return Air Temperature
- Supply Air Temperature
- Ambient Air Temperature
- Defrost Termination Temperature 2
- Compressor Discharge Temperature
- Engine Coolant Temperature
- Compressor Discharge Pressure
- Compressor Suction Pressure
- Battery Voltage
- Battery DC Current
- Engine RPM
- Remote Sensors 1 thru 3

Time Intervals

The following intervals are available for sensor recording:

- 2 Minutes
- 5 Minutes
- 10 Minutes
- 15 Minutes
- 30 Minutes
- 1 Hour
- 2 Hours
- 4 Hours

DATA RECORDING (CONTINUED)

Optional Sensors and Events

In addition to the above Sensors and Events, the DataRecorder also has the capabilities to record the following:

- Remote Temperature Sensor 1
- Remote Temperature Sensor 2
- Remote Temperature Sensor 3
- Remote Switch 1
- Remote Switch 2
- Door Switch
- Fuel Tank % Level

3.18.4 Data Downloading

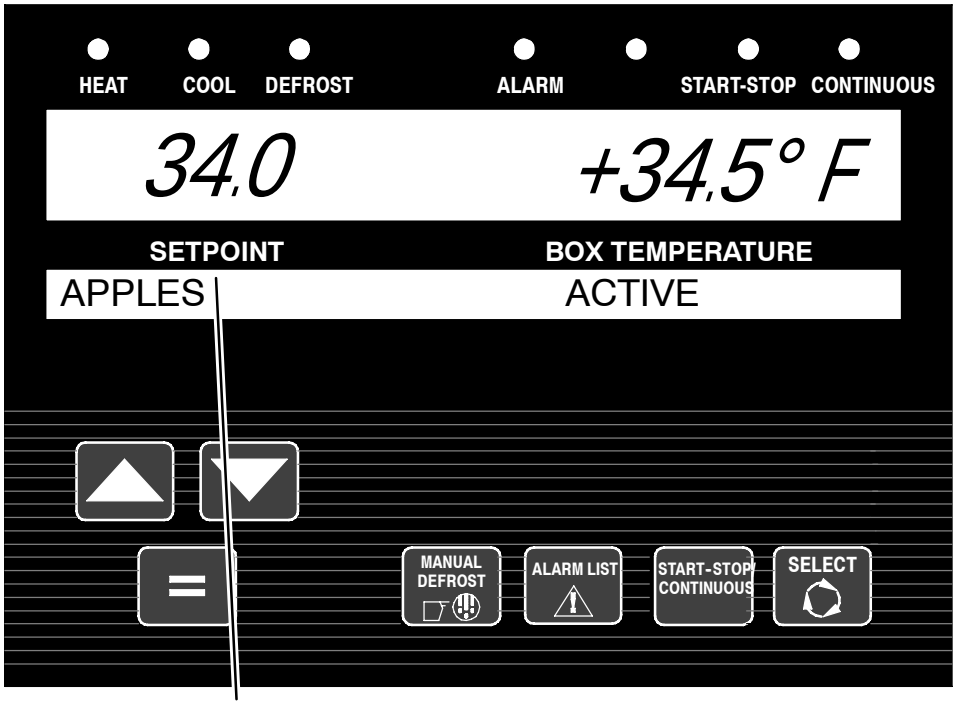
The data within the DataRecorder can be downloaded from the DataRecorder by using either the ReeferManager, (a PC software program) and a download cable connected to the download port (refer to Section 5.1) or with a Download PC card (refer to Section 5.3) If a PC card is used, the ReeferManager program is then used to extract the data from the PC card, and place it on the computer hard disk.

3.18.5 DataRecorder Power-Up

The DataRecorder records data the entire time the START/RUN-OFF switch is in the Run position. A configuration exists which allows the user to select either an additional eight hours of data to be recorded after the START/RUN-OFF switch is placed in the OFF position, or to stop recording at the same time the (START/RUN-OFF switch) is turned to the Off position. (See Configuration List Section 5.2.1.)

3.19 OPTIONS

3.19.1 IntelliSet



DURING START UP

Observe the MessageCenter during the power up process. If the unit is equipped with IntelliSet, the name of the active or modified IntelliSet will be displayed for approximately 10 seconds before the engine starts.

DURING OPERATION

Press = key to view current IntelliSet. (IntelliSet Hot Key must be enabled in configurations. See Section 5.2.1)

Press either the Up or Down Arrow key to scroll through the list of IntelliSets. The current IntelliSet will have either the word ACTIVE or MODIFIED after it. MODIFIED indicates that one or more of the IntelliSet settings within the microprocessor has been changed. To change MODIFIED to ACTIVE, press = key while the IntelliSet is shown in the MessageCenter.

The Advance microprocessor offers over 48 parameters that may be set depending on the product being carried. IntelliSet allows the owner to pre-program specific product settings into the microprocessor and give the settings a name. The operator may then call up these settings by simply selecting the IntelliSet name.
For example: Apples may require continuous operation at 35°F (1.7°C) with a defrost every three hours while a load of cheese may require the same operation with setpoints ranging from 35°F to 42°F (1.7°C to 5.6°C) and a load of ice cream requires Start-Stop operation at -22°F (-30°) with defrost at 12 hour intervals. The settings required for each product may be entered into the microprocessor and then locked so they cannot be changed. In the case of the cheese, the range of setpoints may be locked, leaving the operator the ability to change the setpoint within the locked range.
When a load of apples is going to be picked up, the operator simply selects “APPLES” from the IntelliSet menu; for cheese, “CHEESE” is selected and the setpoint reset as required; for ice cream, “ICE CREAM” is selected. With each selection, the microprocessor automatically reprograms the settings to provide the best temperature control, fuel economy, and performance for that particular product.

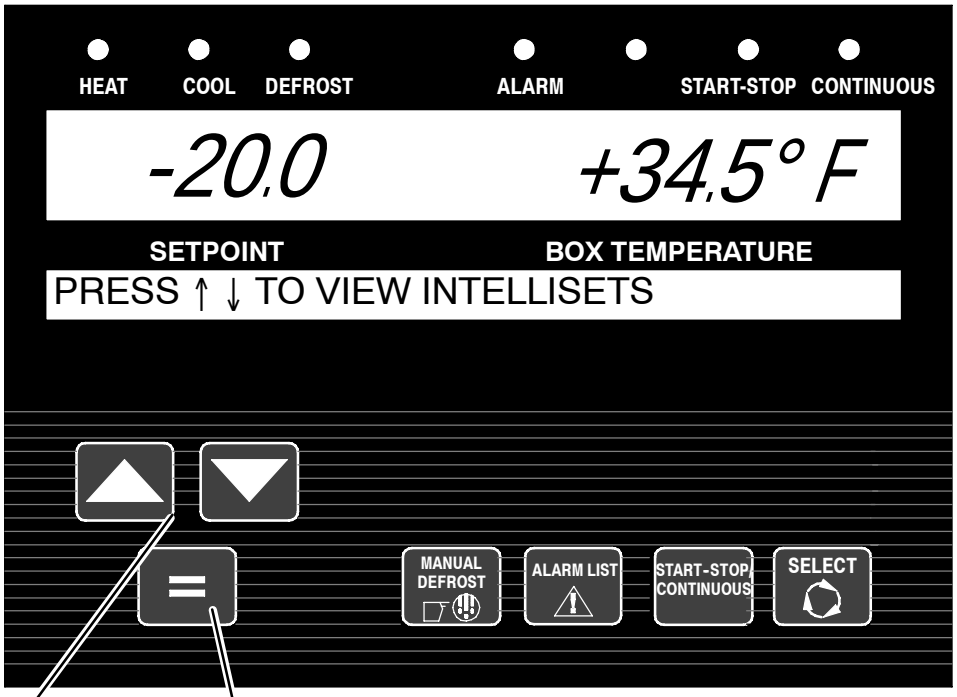
NOTE

IntelliSet #31 is pre-programmed as “IntelliSleep” which allows Sleep mode (See Section 3.7) to be entered by simply changing to that IntelliSet.

NOTE

The above settings are **examples** of possible settings. Except for IntelliSleep, IntelliSets are not factory set. They are developed by individual customers.

a. Changing IntelliSets



1. PRESS = Key to display current IntelliSet. (Enable IntelliSet at = Key must configured ON. See Section 5.2.1.) If the = Key is not enabled, press the Select Key until the MessageCenter shows PRESS ↑ ↓ TO VIEW INTELLISETS.

2. Press the UP or DOWN ARROW key, to move through the IntelliSet List. The current IntelliSet will have either ACTIVE or MODIFIED to the right of the name.

3. To use a different IntelliSet or to change the current IntelliSet from "modified" to "active," bring the IntelliSet you wish to use into the MessageCenter and press = Key.

3.19.2 DataTrak™ for Advance Microprocessors

DataTrak allows remote communication providers (cellular, satellite, etc) to request data from the Advance microprocessor and have it transmitted via their equipment to another location. This is typically done via the internet to any destination in the world. Providers can also send commands via their equipment to the Advance microprocessor to change settings and the way the controller is operating the unit.

DataTrak is an optional feature. The DataTrak option is installed by inserting a DataTrak PC Card into the PC Card slot of the microprocessor and following the on–screen instructions on the keypad.

The DataTrak Option installation can be confirmed by scrolling through the Unit Data List (see Section 3.13). DataTrak will be listed under the Installed Options heading if it is installed.

Once DataTrak is installed, the Advance Microprocessor must be properly configured for the provider that will be connecting to it. This is done in the configuration list (see section 5.2.1.) The Satellite Com configuration can be set for “Qualcomm” or “Other”. If the provider is “Qualcomm” then this selection must be made. All other communications providers use the “Other” selection.

Carrier Transicold has worked with approved communication providers with recommended installation locations, and wiring connections to Carrier units. Instructions for installing this equipment is supplied by each individual provider, and not by Carrier Transicold. Communications electrical harnesses and serial port splitters are available from Carrier Transicold Replacement Components Group (RCG).

Communication Providers will connect into the wiring harness at the SATCOM port, and possibly at the J1 connector. Testing the SATCOM port may be done using a serial port to PC cable (22–01690–00) and the ReeferManager program. If ReeferManager can communicate with the microprocessor the unit wiring and microprocessor are performing normally and any communication problem is with the provider’s equipment.

3.19.3 Two-Way Remote Communication

There are several different Telematics providers whose systems are approved for one-way or possibly two-way communications with Carrier Transicold Truck / Trailer / Rail refrigeration equipment. Current information on each of these systems is available on the Carrier Transicold TransCentral Information Center. Please visit www.transcentral.carrier.com.

⚠ WARNING

UNITS EQUIPPED WITH STAR-TRAK TWO WAY COMMUNICATION CAPABILITIES MAY HAVE THE ABILITY TO BE STARTED OR TURNED OFF REMOTELY REGARDLESS OF THE SETTING OF THE START/RUN-OFF SWITCH.

The unit is controlled locally and there can be no two-way communication when the Mode switch on the Remote Monitoring Control Box is in MAINTENANCE MODE. Therefore, when performing any work on the unit, place the mode switch in MAINTENANCE MODE. After the unit is serviced, return the mode switch to REMOTE ON.

3.19.4 AutoFresh Air Exchange

To activate AutoFresh operation, the AutoFresh Air Exchange configuration needs to be set (See Section 5.2.1). A second configuration, AutoFresh Air Delay, can be used to delay the start of AutoFresh operation by up to 48 hours after engine start-up.

Two functional parameters (See Table 3-3) are used to choose the type of fresh air exchange. The AutoFresh Air Exchange parameter is used to choose the type of fresh air control. The AutoFresh Air Control parameter is used to select the cycling of the assembly if CFM CONTROL has been set.

The air exchange rate can be adjusted from zero to the maximum at the microprocessor. Maximum rate is 50 CFM.

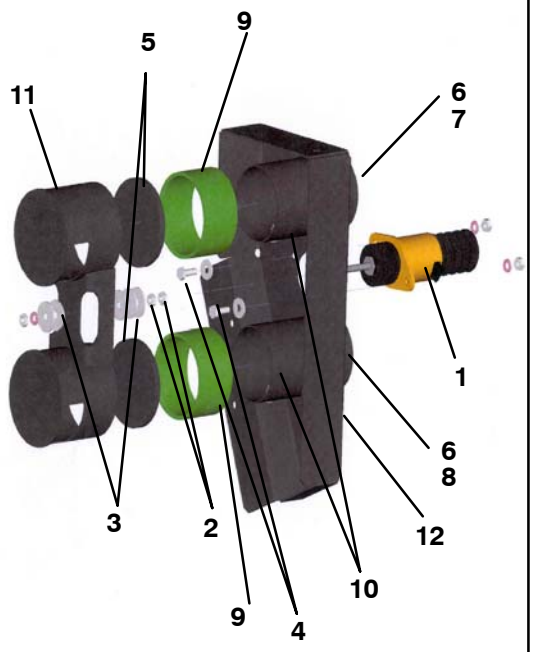
AutoFresh Air Exchange controls the amount of CFM exchanged based on a 20-minute duty cycle. The duty cycle timer is reset whenever the START/RUN-OFF switch is turned OFF, then back ON, or if the unit is shut down by either a Door or Remote switch shutdown.

When the ambient air temperature is below 36°F (2.2°C) and the AutoFresh Air Exchange functional parameter is set for OPEN, the AutoFresh Solenoid (AFAS) will always be closed for the last 15 seconds of each 20-minute time block and then reopen. Closing and opening the vent periodically prevents ice buildup from freezing the solenoid or air door into the open position.

The AutoFresh solenoid current draw is tested during Pretrip Test #2; however, it is a good idea for the technician to visually verify that the solenoid actually pushes the air assembly open, then closed again. This operation is visible from ground level, by looking up at the curbside of the unit. See Figure 3-2 and Figure 3-3.

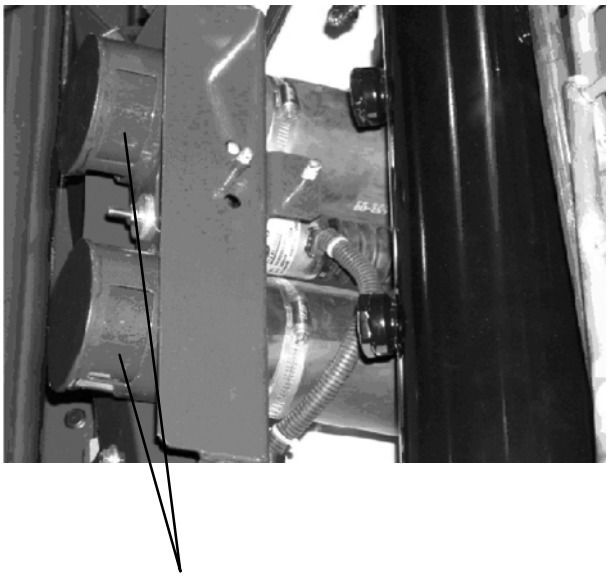
With the introduction of unfiltered air into the refrigerated compartment, “dirty” air may be drawn into the air stream and be deposited onto the fan blades, reducing the airflow and ventilation. Periodically, the fan blades must be inspected and cleaned, if necessary, to maintain optimum air flow and air exchange performance.

ITEMS 6, 7 AND 8 ARE NOT ACTUALLY SHOWN . ONLY LOCATIONS ARE INDICATED.



1. Solenoid
2. Jam Nut
3. Washer
4. Cap Screw
5. Gasket
6. Hose Clamp
7. Inlet Hose
8. Outlet Hose
9. Sleeve
10. Push-In Fastener
11. Rail Cap Assembly
12. Rail Bracket Assembly

Figure 3-1. AutoFresh Air Exchange



AIR OPENINGS POINT DOWN TO PREVENT RAIN WATER ENTRY.

Figure 3-2. AutoFresh in Closed Position

Figure 3-3. AutoFresh in Open Position

SECTION 4

ENGINE AND TEMPERATURE CONTROL

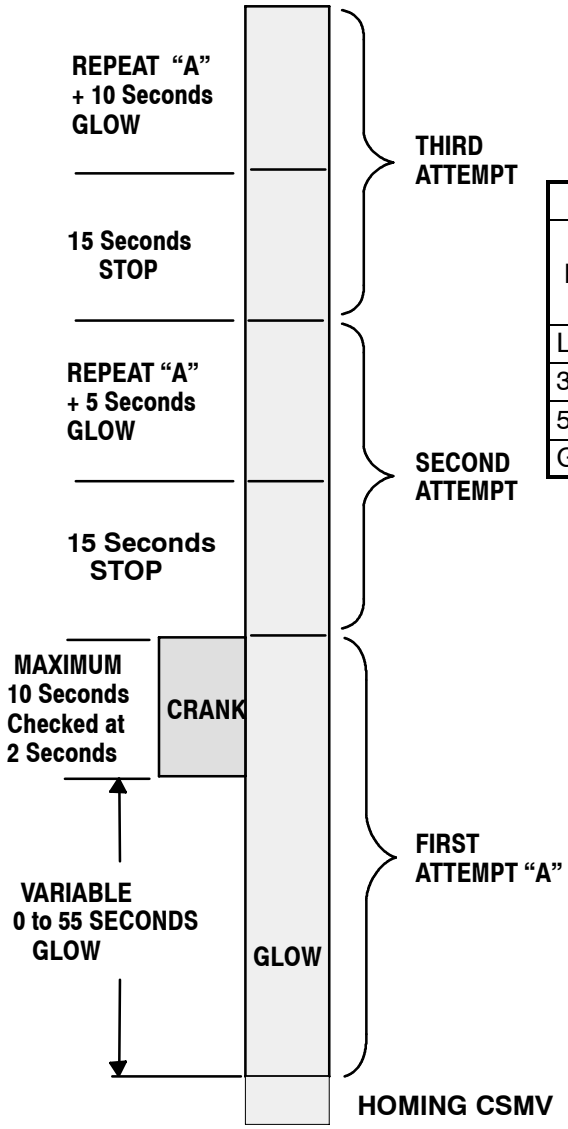
4.1 AUTO START SEQUENCE

When the starting conditions are met the start sequence will begin by fully closing (0% Open) the Compressor Suction Modulation Valve (CSMV). The CSMV will then open. When it reaches 30% the starting sequence continues by energizing the Run and Clutch relays, along with the solenoid valve (SV2) and both unloaders (UL1 and UL2.) After 5 seconds the Glow Plug Relay (GPR) will energize to supply power to the glow plugs and the buzzer will sound for 5 seconds before the starter is energized. On initial power-up, there will be a 5 second delay before the starting sequence begins. If the required glow time is zero (warm engine, short glow time), the microprocessor will energize the starter after a 5 second delay. The engine will crank for a maximum of 10 seconds or until the engine is "running". The glow relay will also be de-energized at the same time the starter disengages. If the engine does not start, a 15 second rest period will elapse before the next start attempt. The Run Relay, Clutch Relay, both unloaders and SV2 will remain energized and CSMV will remain in pre-start position until the next starting sequence.

Before beginning another starting sequence, the oil pressure is checked to determine if the engine is running or the RPM sensor has failed. For the second and third start attempts the glow time is increased by 5 seconds over the glow time of the first attempt listed below. The microprocessor allows three start attempts (without the engine starting) before the starting is locked out and the Failed To Start – Auto Mode alarm is activated.

NOTE

If the Engine Coolant Temperature Sensor alarm is Active, the glow time for temperatures less than 32°F (0°C) will be used.



Auto Start Sequence

4.1.1 Variable Glow Time

The glow time for the first start attempt will vary in duration based on engine coolant temperature and how the microprocessor is configured: Short or Long as follows:

Table 4-1. Glow Time

Engine Coolant Temperature	Glow Time in Seconds	
	Short (Default)	Long
Less than 32°F (0°C)	15	55
33°F to 50°F (1°C to 10°C)	10	40
51°F to 77°F (11°C to 25°C)	5	25
Greater than 78°F (26°C)	0	10

The second start attempt has five seconds of glow time added to the time shown in the table. The third start attempt will have 10 seconds added. If the coolant temperature sensor is defective, the microprocessor assumes a temperature of less than 32°F (0°C) for the glow timing.

4.1.2 Engine Running

The engine is considered to be running when:

a.Engine RPM are greater than 1000, and

b.The engine oil pressure switch contacts are closed within 15 seconds of the engine starting.

OR if the RPM sensor is not reading correctly, and the engine is being started for the second or third attempt, the engine is considered to be running when:

a.For ambient temperatures at or above 32°F (0°C) the engine oil pressure switch contacts are closed.

b.For ambient temperatures below 32°F (0°C) the alternator charging amps are more than 2 amps.

NOTE

If either of these two cases occurs, alarm 130 – CHECK ENGINE RPM SENSOR will be activated.

NOTE

While the starter is engaged, if the engine speed is less than 50 RPM for more than 3 seconds, the SSR will de-energize to stop the starter.

NOTE

If the ambient air temperature is above 120°F (48.9°C) when the engine starts, the unit will operate in low speed, 2 cylinder operation for the first 2 minutes before allowing high speed Heat or Cool operation or allowing either unloader to load. If Defrost is started, this override will be ignored, and the unit will go to the correct speed for Defrost.

4.1.3 Initial Engine Operation

If a unit is started when the Engine Coolant Temperature is 79°F (26°C) or below, after the engine starts, the unit will immediately go to low speed 4 cylinder operation until the water temperature reaches 79°F (26°C). The CSMV will control suction pressure to 78 PSIG (5.3 Bars) Max. during low speed 4 cylinder operation. (Refer to Chart, Section 4.7). Once the water temperature is greater than 79°F (26°C), the unit will run at high speed 4 cylinder operation and the CSMV will control to a maximum suction pressure of 42 PSIG (2.9 Bars). (Refer to chart). When the RAT reaches 50°F (10°C), the unit will go to 6 cylinder cool operation and the CSMV will control to a maximum suction pressure of 27 PSIG (1.8 Bars). The unit will continue in high speed 6 cylinder cool until the controlling temperature is 3.2°F (1.8°C) away from setpoint. The microprocessor will then follow the ladder logic on Figure 4-2.

4.2 START-STOP OPERATION

Start-Stop is provided to permit starting/stopping/restarting of the engine–driven compressor as required. This feature allows full automatic control of the engine starting and stopping by monitoring refrigerated compartment temperature, battery charging amps, and engine coolant temperature. The main function of automatic engine cycling is to turn off the refrigeration system near setpoint to provide a fuel efficient temperature control system and to initiate a restart sequence after certain conditions are met. The Start-Stop/Continuous key is pressed to select between Continuous Run and Start-Stop operating modes.

NOTE

The microprocessor may be locked so that the unit will always operate in Start-Stop whenever the setpoint is within a specific range. Refer to Range Lock (Section 4.5.1) and ProductShield (Section 4.5.2) for additional information.

4.2.1 Start-Stop Mode

Whenever the unit starts in Start-Stop Mode, it will continue to run until all five of the following criteria have been satisfied:

a. It has run for the predetermined Minimum Run Time: The Minimum Run Time is selected in the microprocessor Functional Parameter list. (Refer to Section 3.15). The purpose of this is to force the unit to run long enough to completely circulate the air inside the compartment, and to ensure that the product temperature is at setpoint. This may be set for any value between four minutes and 60 minutes in one minute intervals. The engine must run for the Minimum Run Time before cycling off. The factory setting is four minutes.

b.The engine coolant temperature is above 122°F (50°C). If the unit can not cycle off, it will operate as if in Continuous Run mode. The engine coolant temperature will override the minimum off time and out-of-range condition to force engine restarting when the engine coolant temperature drops below 34°F (1°C). If the engine coolant sensor alarm is active and the ambient temperature is above 32°F (0°C), the engine coolant temperature will be ignored for the OFF cycle. If the engine coolant sensor alarm is active and the ambient temperature is below 32°F (0°C) or the ambient temperature sensor alarm is also active, the unit will run for a minimum of 20 minutes before allowing an OFF cycle.

c. The battery voltage is high enough.. Provisions are made to sense when the battery voltage is correct. A good battery is defined as having 13.4 VDC at 75°F (23.9°C). This voltage varies with ambient temperature.

d. The battery charging amps are low enough. Provisions are made to sense when the battery charging amps are low enough to indicate that the battery is sufficiently charged. The battery is sufficiently changed when the charging rate is below that selected in the Configuration List. The selectable range is 1.0 to 10.0 amps in 0.5A increments. The factory setting is 6.5 Amps. (See Section 4.2.6).

NOTE

When conditions b., c. and d. are all met, “OK” will appear in the Unit Data List for battery voltage.

Table 4-2 Battery Voltages

Voltage	Description
10 VDC or Less	Unit will shut down except during cranking.
12.2 to 13.4 VDC	If the unit has cycled off in Start–Stop mode and battery voltage drops below the selected voltage in the Configuration List (the selectable range is 12.0 to 12.8 vdc)12.2 volts is the factory setting (see 4.2.2.2 below). the unit is automatically started in order to charge battery. This restart criteria will override the Minimum Off Time and restart temperatures. The unit will operate until all conditions required for an off cycle are again met.
17 VDC or more	Unit will shut down.

e. The compartment temperature is at setpoint: After the Minimum Run Time expires, the unit will go into an Off Cyclewhen the compartment temperature is within ±0.5°F (±0.3°C) of setpoint for setpoints in the Perishable range or is less than +0.5°F (+0.3°C) above setpoint for setpoints in the Frozen range.

4.2.2 Restart

A restart will be initiated when any one of the following conditions occurs:

a. Engine coolant temperature drops below 34°F (1°C): However, if the coolant sensor alarm is active, theunit will restart if the ambient air temperature drops to 32°F (0°C) after the unit has been in the OFF cycle for 60 minutes.

b. Battery voltage falls below the configured value: (See Configuration list 5.2.1). The selectable range is between 12.0 to 12.8 VDC. The factory setting is 12.2 VDC.

c. Compartment Temperature has exceeded Off Time Override Temperature: compartment temperature is more than the selected Off Time Override Temperature (Functional Parameter) of 3.6°F to 18°F (2°C to 10°C) from setpoint (above setpoint in the frozen range). The factory setting is 11.0°F (6.1°C).

d. The Minimum Off Time Has Expired: The Minimum Off Time has expired and the compartment temperature has moved away from setpoint by more than 3.6°F (2°C). The Minimum Off Time allows the unit to remain off for extended periods of time, maximizing fuel economy. The Minimum Off Time is selected in the microprocessor Functional Parameter list . (Refer to Section 3.15). Settings may be for 10 minutes to 90 minutes in one minute intervals. The factory setting is 20 minutes.

   During the Minimum Off Time, the microprocessor continually monitors the compartment temperature. If the temperature should go beyond the Off Time Override Temperature, the unit will restart, regardless of how much Off Time remains. The Off Time Override Temperature is selected in the microprocessor Functional Parameter list . (Refer to Section 3.15) This can be set for 3.6°F to 18°F (2°C to 10°C) in 0.5° increments. After the Minimum Off Time, the unit will restart when the compartment temperature goes beyond ±3.6°F (±2.0°C) of setpoint for the Perishable range or above +3.6°F (+2.0°C) of setpoint for the Frozen range.

e. The Maximum Off Time has expired: In some ambient conditions, there are times when the unit may be off for very long periods of time. To ensure that the entire load stays within safe temperature ranges, the Maximum Off Time may be used to force the unit to restart. Maximum Off Time is selected in the microprocessor Functional Parameter list . This may be set for OFF, or 10 minutes to 255 minutes in one minute intervals. When the Maximum Off Time expires, the unit will restart, regardless of any change in compartment temperature. The factory setting is OFF.

NOTE

The unit may remain in low speed for 10 minutes (Factory Setting) after engine start-up when in Start-Stop Mode. High speed delay can be set from Off to 255 minutes in one minute increments. (Refer to Functional Parameters, Section 3.15).

TIP

While the unit is running, the status of the unit battery and engine coolant temperature can be readily checked by reading the Battery Voltage in the Data List. If “O.K.” appears after the voltage reading, battery voltage, battery charging amps and engine coolant temperature are sufficient to allow the unit to cycle off. If “O.K.” does not appear, then one or more of these conditions have not been met, and the unit is not ready to cycle off.

4.2.3 Start-Stop Indicator

To indicate that the unit is in the “Start-Stop” mode, the Start-Stop LED indicator and Engine Auto Start lights on the light bar will be illuminated.

4.2.4 Failed To Start - Auto Mode

If the unit fails to start after three start attempts, the Alarm A31-FAILED TO START-AUTO MODE will appear in the MessageCenter, and the Alarm LED on the Keypad and the Fault light on the light bar will flash on and off once a second.

a. **X2 units only** – During a Start–Stop OFF cycle, the micro continues to monitor the ambient air temperature. If the ambient air temperature rises to115°F (46°C), SV4 will energize for 45 seconds to equalize the refrigeration system pressures. This will occur only once during an Off Cycle, but may be repeated during subsequent Off Cycles.

4.2.5 Start–Stop Parameters

The selectable Start-Stop parameters in the Functional Parameter list can be applied to Start-Stop operation so that:

a. The same settings apply to any setpoint, or

b. The settings can be specified to be different, depending on whether the setpoint is above +10.4°F (-12°C) (in the perishable range), or +10.4°F (-12°C) or below (in the frozen range). The decision as to whether the same settings will be used together for all setpoints or if they will be separated between perishable and frozen is made in the Configuration list (refer to Section 5.2).

If **TOGETHER** is selected in the Configuration list , then the following Functional Parameter values will be available for use:

- MINIMUM RUN TIME
- MINIMUM OFF TIME
- OVERRIDE TEMP
- MAXIMUM OFF TIME
- FROZEN SHUTDOWN OFFSET

If **SEPARATE** is selected in the Configuration list , then the following Functional Parameter values will be available for use:

- PERISHABLE MINIMUM RUN TIME
- PERISHABLE MINIMUM OFF TIME
- PERISHABLE OVERRIDE TEMP
- PERISHABLE MAXIMUM OFF TIME
- FROZEN MINIMUM RUN TIME
- FROZEN MINIMUM OFF TIME
- FROZEN OVERRIDE TEMP
- FROZEN MAXIMUM OFF TIME
- FROZEN SHUTDOWN OFFSET

NOTE

In the event that different values for both Perishable and Frozen Start-Stop times are selected in the Functional Parameter list , then the Configuration is changed from Separate to Together. The values from the Perishable times will be the ones that will be used.

4.2.6 Charging Amps

A Configuration for Start-Stop Shutoff Configuration exists which allows the microprocessor to monitor battery charging amperage in addition to battery voltage. The battery charging rate (as seen in the Data list) must be below the selected amp setting to allow the unit to cycle off.

The Configuration may be set from 1.0 to 10.0 Amps in 0.5 amp increments. A weak or defective battery may show a suitable voltage charge while the alternator is putting a high charging rate into it, then not be sufficiently charged to restart the engine at the end of a Start-Stop Off Cycle.

The factory setting for this configuration is 6.5 amps. This is a general setting that may need to be adjusted for the operating environment of the unit. Units operated in colder ambient temperatures may want to decrease this setting to force a higher charge in the battery prior to Start-Stop Off Cycle. Units operated in warmer ambient temperatures may use a higher setting.

As a battery ages, it is normal for it to require longer recharging periods. If the running time is gradually increasing in Start-Stop operation due to the battery requiring a longer charging period, this run time may be shortened by raising the amp setting. (This may be seen by reviewing downloaded data and looking at the amp reading during prolonged engine Start-Stop On Cycles.)

4.3 CONTINUOUS RUN OPERATION

In the Continuous Run mode, the engine will not shut down except for shut down alarms or if the engine stalls. Continuous Run operation is normally used for fresh produce and other sensitive product loads. The Start-Stop/Continuous key is pressed to switch between Continuous Run and Start-Stop operating modes

NOTE

The microprocessor may be locked so that the unit will always operate in Start-Stop or in Continuous Run whenever the setpoint is within a specific range.
Refer to Section 4.5.1 – Range Lock and Section 4.5.2 – ProductShield Econo – for additional information.

NOTE

The unit will remain in low speed until water temperature reads 79°F (26°C) in Continuous Run Mode. Low Speed Startup can be changed from OFF to 255 minutes. Refer to Functional Parameters in Section 3.15.

4.4 TEMPERATURE CONTROL

4.4.1 Perishable and Frozen Setpoint Ranges

There are two ranges defined for setpoint.

a. Setpoints above +10.4°F (-12°C) are considered Perishable.

b. Setpoints of +10.4°F (-12°C) or below are considered Frozen.

	Perishable	Frozen
Temperature Control	When the compartment temperature is near setpoint, the unit will cycle from Heat to Cool to Heat to maintain temperature.	When the compartment temperature is near setpoint, the unit will operate in Cool with UltraFreeze operating at compartment temperatures more than 3°F (1.7°C) below setpoint.
High Air Flow	Continuous High Air Functional Parameter is Available ProductShield High Air is Available	Continuous High Air Flow is not allowed when the compartment temperature is less than 3.2F (1.8C) above setpoint. ProductShield High Air is available.
Start/Stop Off Cycle	Compartment temperature criteria is satisfied when the temperature is 0.5°F (0.3°C) above or below setpoint.	Compartment temperature criteria is satisfied when the temperature is within 0.5°F (0.3°C) above setpoint.
Start/Stop Restart	Unit will restart when compartment temperature is above or below setpoint by the restart value. Restart value during the Minimum Off Time is the Override Temperature selected in the Functional parameter list. Restart value following the Minimum Off Time is 3.6F (2.0C).	Unit will restart when compartment temperature is above setpoint by the restart value. Restart value during the Minimum Off Time is the Override Temperature selected in the Functional parameter list. Restart value following the Minimum Off Time is 3.6F (2.0C).
Cargo Protect Mode (Both RAT and SAT sensor alarms are active.)	Unit will shut down.	Unit will operate in low speed six cylinder cool.

4.4.2 Pulldown / Pull-up Mode

During pulldown mode the unit will run in high speed and high speed capacity (unless there is a high speed override – Refer to Section 4.6.1)

Pulldown or Pull-up will be initiated in any of the following conditions:

1. At engine start
2. Setpoint change
3. Operational mode change such as: Start-Stop, Continuous Operation
4. Defrost termination
5. If the system is running in Start-Stop Run Mode, the minimum run time has expired, and other conditions for shutdown are met except that the compartment temperature has not reached setpoint.
6. Pretrip termination

Pulldown or Pull-up will end in the following conditions:

1. For Continuous Run Mode:
   - When the RAT and SAT are equally spaced above and below setpoint, $\left(\frac{SAT - RAT}{2}\right)$ equals setpoint for setpoints below 60°F (15.6°C), and both supply and return air sensors are good.

NOTE

Temperature control is achieved by controlling engine speed, compressor UL1 and UL2 unloaders, and solenoid valves (SV1, SV2, SV4, and the CSMV).

2. For START-STOP Mode:

The selected Control Probe Temperature is within+/- 0.5F (0.3C) of setpoint.

NOTE

When the system leaves Pulldown (Cool) or Pull-up (Heat) modes, it will enter UltraFresh 3 temperature control mode (see Section 4.4.5) when the setpoint is between +10.4°F and 65°F (-12°C to 18.4°C). For setpoints at or below +10.4°F (-12°C), the unit will operate in Cool and UltraFreeze (see Section 4.4.5), For setpoints above 65°F (18.4°C), the unit will operate in Cool and Heat, but will not operate in UltraFresh 3.

4.4.3 Heat Mode Operation - In the Heat Mode, the microprocessor will operate the unit controls as follows:

SV1	SV2	SV4	Engine Speed	Clutch Output	UL1	UL2	CSMV
CLOSE	Refer to SV2 Operation	OPEN	Refer to Section 4.4.7	ENGAGE	Refer to UL1 Operation	Refer to UL2 Operation	100% Open

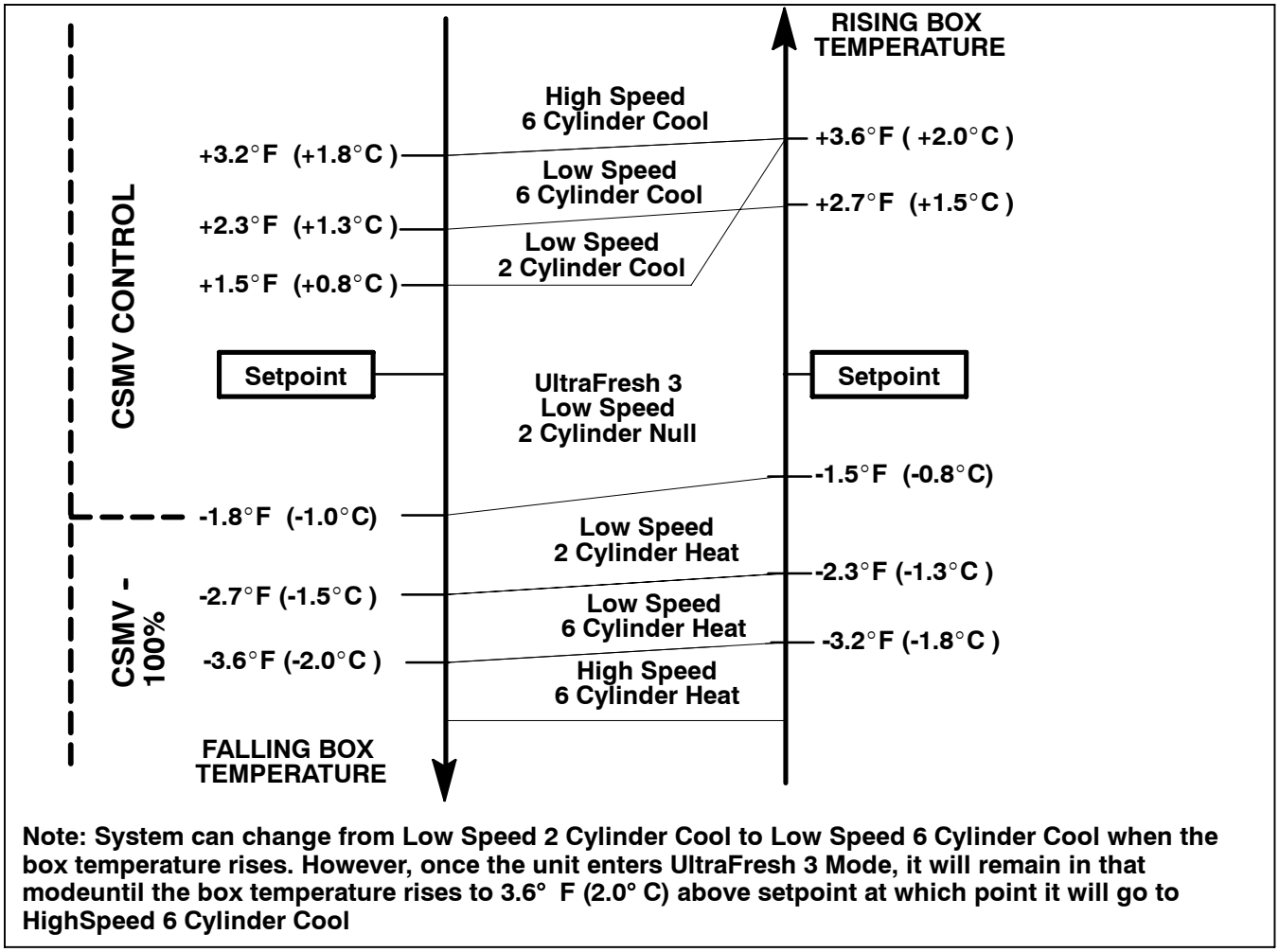
4.4.4 Cool Mode Operation - In the Cool Mode, the microprocessor will operate the unit controls as follows:

SV1	SV2	SV4	Engine Speed	Clutch Output	UL1	UL2	CSMV
OPEN	OPEN	CLOSE	Refer to Section 4.4.7	ENGAGE	Refer to UL1 Operation	Refer to UL2 Operation	Refer to CSMV Control

NOTE

The CSMV maintains the maximum suction pressure of the refrigeration system. The selected controlling sensor determines if the unit is running high speed or low speed and six or four or two cylinders. The controlling sensor may be RAT or SAT depending if the the microprocessor is configured for Return Air Control or Supply Air Control. Refer to Chart in Section 4.7 for maximum suction pressure limits during each mode of operation in Cool Mode.

Note: The following temperature control operating sequence diagrams are after pulldown and do not show overrides.



Note: System can change from Low Speed 2 Cylinder Cool to Low Speed 6 Cylinder Cool when the box temperature rises. However, once the unit enters UltraFresh 3 Mode, it will remain in that modeuntil the box temperature rises to 3.6° F (2.0° C) above setpoint at which point it will go to HighSpeed 6 Cylinder Cool

Figure 4-1. Continuous Run Temperature Control Operating Sequence - Perishable Range

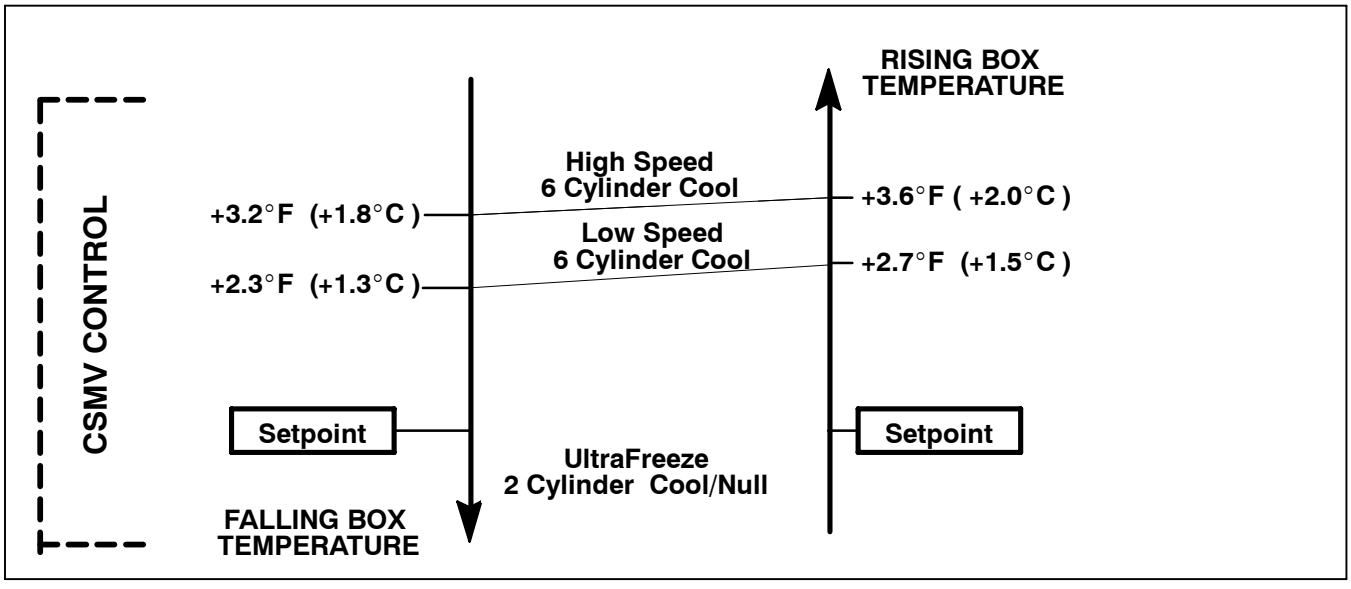
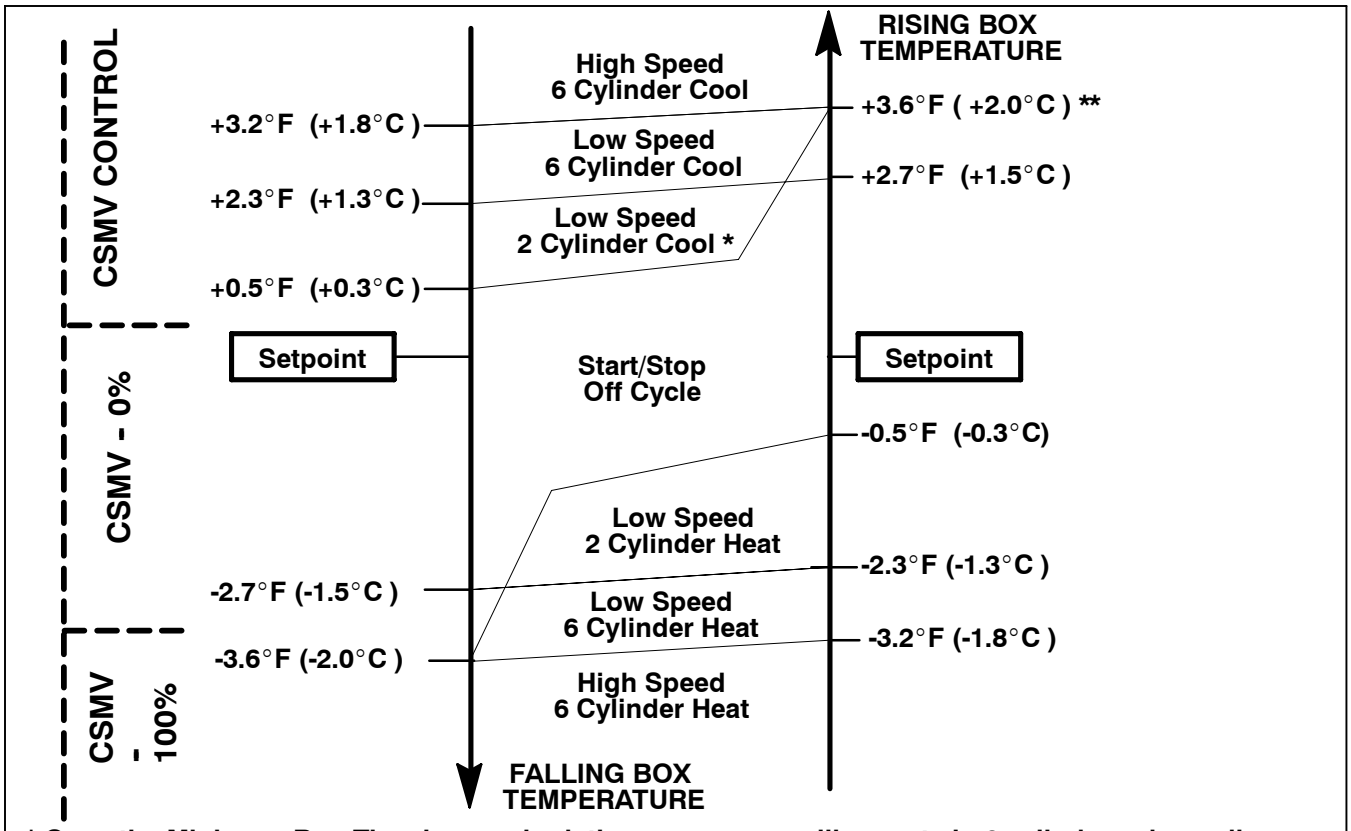


Figure 4-2. Continuous Run Temperature Control Operating Sequence - Frozen Range

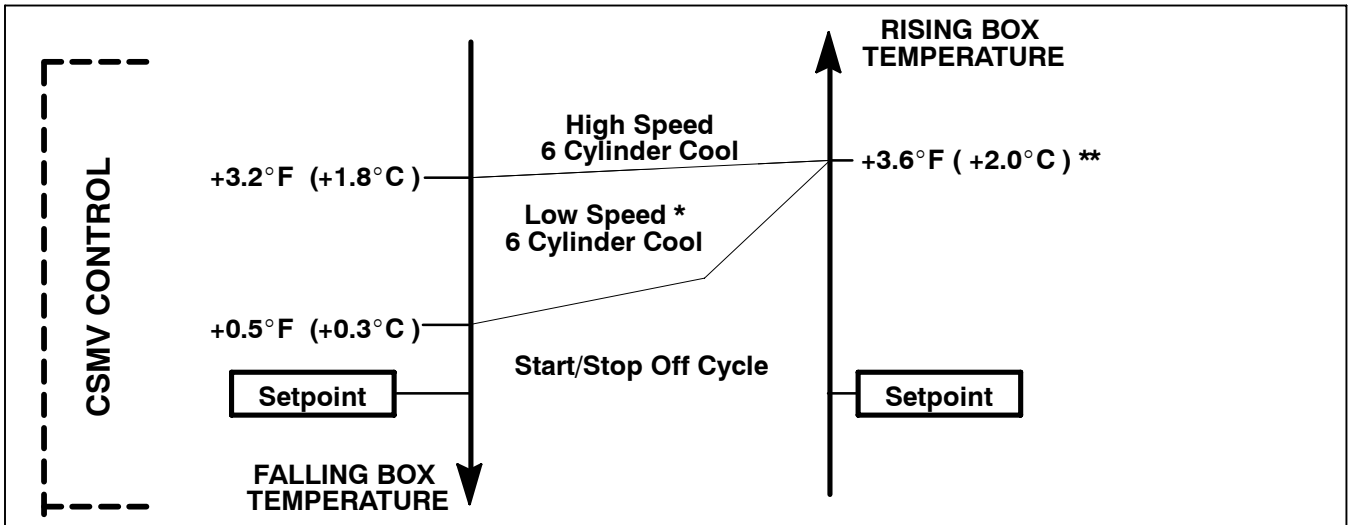


*** Once the Minimum Run Time has expired, the compressor will operate in 6 cylinders, depending on suction pressure**

**** During the Minimum Off Time, the unit will restart at Override Temperature selected in the Functional Parameter List.**

Note: System can change from Low Speed 2 Cylinder Cool to Low Speed 6 Cylinder Cool when the box temperature rises. However, once the unit enters UltraFresh 3 Mode, it will remain in that modeuntil the box temperature rises to 3.6° F (2.0° C) above setpoint at which point it will go to HighSpeed 6 Cylinder Cool

Figure 4-3. Start-Stop - Temperature Control Operating Sequence - Perishable Range



*** Once the Minimum Run Time has expired, the compressor will operate in 6 cylinders, depending on suction pressure**

**** During the Minimum Off Time, the unit will restart at Override Temperature selected in the Functional Parameter List.**

Figure 4-4. Start-Stop - Temperature Control Operating Sequence - Frozen Range

4.4.5 ULTRAFRESH 3 TEMPERATURE CONTROL

UltraFresh 3 is an advanced method of temperature control for both Perishable or Frozen ranges. It produces a reduced capacity state by: throttling down the CSMV and pulsing the SV4 valve (SV4 Pulse Mode), or mixing heating and cooling modes (Pulsed Null Mode).

UltraFresh 3 uses both the supply and return air sensors to control compartment temperature.

The sensor that is selected under the Functional Parameters for the temperature control is known as the "Selected Probe." This is the probe that will be used to determine when the temperature is at setpoint.

The "Active Probe" is the sensor actually used by the microprocessor to perform the temperature control. It is the same as the "Selected Probe," unless that sensor is not installed or is defective or if supply is the selected probe in Frozen Range.

SELECTED PROBE	ACTIVE PROBE
Return Air Sensor	Return Air Sensor (only)
Supply Air Sensor	Supply Air Sensor (Perishable Range) Return Air Sensor (Frozen Range)

In the case of a bad probe, the remaining probe will be used for temperature control.

a.Heat/Cool/Null Switching Operation

There are three possible modes for UltraFresh 3 control temperatures. These are Heat, Cool and Null. When not in pulldown, UltraFresh 3 controls the unit based on the following: (Refer to the temperature control operating sequence diagrams).

1. To exit NULL and enter COOL while in Continuous Run, the control temperature must be greater than or equal to 3.6°F (2°C) above setpoint.
2. To exit NULL and enter COOL while in Start/Stop, the control temperature must be greater than or equal to 1.8°F (1°C) above setpoint.
3. To exit cool and enter NULL Band while in either Continuous Run or Start/Stop, the control temperature must be less than 1.5°F (0.8°C) above setpoint.
4. To exit NULL Band and enter HEAT, the control temperature must be more than or equal to 1.8°F (1°C) below setpoint.
5. To exit heat and enter NULL Band the control temperature must be less than 1.5°F (0.8°C) below setpoint.

b.Null Band Operation

Null Band consists of:

1. Pulsed Null Mode Operation

Reduced capacity is produced between the Heat and Cool Modes by a mode known as Pulsed-Null. This mode is not a constant operating mode, but only operates for a few seconds at a time. During Pulsed-Null, the heat and cool valves are opened simultaneously to reduce either the heating or cooling capacity. In the Null Band (Refer to the following charts), the unit will pulse between Cool and Null, or Heat and Null in 10 second increments. The capacity in the Null Band is varied by adjusting the pulse rate.

• Cool Pulsed Mode

SV1	SV2	SV4	Engine Speed	Clutch Output	UL1	UL2	CSMV
OPEN	OPEN	CLOSED	LOW	ENGAGE	UNLOAD	UNLOAD	Refer to CSMV Control

• Null Pulsed Mode

SV1	SV2	SV4	Engine Speed	Clutch Output	UL1	UL2	CSMV
OPEN	OPEN	OPEN	LOW	ENGAGE	UNLOAD	UNLOAD	Refer to CSMV Control

• **Heat Pulsed Mode**

SV1	SV2	SV4	Engine Speed	Clutch Output	UL1	UL2	CSMV
CLOSED	Refer to SV2 Operation Section 4.5	OPEN	LOW	ENGAGE	UNLOAD	UNLOAD	Refer to CSMV Control

Pulsed Null Mode operation will modify the length of each Mode in 10 second cycles. That is, if the unit is in the Cool Null Pulse band, the unit may run in Cool for up to nine seconds, then Null for one second, if the Control Temperature is away from setpoint. As the Control Temperature comes closer to setpoint, the length of Cool time will decrease, and the amount of Null time will increase. However, the combination of the two will always equal 10 seconds. The same is true for the Heat Null band.

2. CSMV Control:

The CSMV will automatically go to 30% when it enters Ultra Fresh 3 at 1.5°F (- 0.8°C) above setpoint. The CSMV will usually control between 30% and 4% depending on the controlling probe and Suction Pressure. However, it can go above 30% for short periods of time. For example, high ambients and low setpoints may cause the CSMV to open higher than 30%.

4.4.6 Cargo Protect Mode

When both the return air sensor (RAT) alarm and the supply air sensor (SAT) alarm are active, the unit will enter Cargo Protect Mode for temperature control. When the setpoint is in the frozen setpoint range, the unit will run low speed loaded cool. WARNING:NO TEMP CONTROL will be displayed. In the perishable setpoint range, the unit will shutdown. (See section 4.4.1 for definition of perishable & frozen setpoints).

4.4.7 Engine Speed Operation

The engine will operate the compressor at two different speeds (low and high). Speed Control is based on the differences of Controlling Temperature and setpoint as follows:

Mode	HIGH SPEED	LOW SPEED
COOL	Control Temp is more than 3.6°F (2.0°C) above setpoint	Control Temp is less than 3°F (1.8°C) above setpoint
HEAT	Control Temp is more than 3.6°F (2.0°C) below setpoint	Control Temp is less than 3°F (1.8°C) below setpoint
NULL	No	Always

NOTE

For X2 units only - When the ambient air temperature reaches 120°F (48.9°C), the engine will go to low speed for a minimum of two minutes, and until the ambient air temperature drops below 110°F (43.3°C).

4.4.8 Defrost

Defrost is an independent cycle overriding cooling and heating functions in order to de-ice the evaporator as required. When the unit is in Defrost, the DEFROST LED will be on, the MessageCenter will display DEFROST CYCLE STARTED for the first 5 seconds, then the default message will be displayed for the rest of the Defrost Cycle. The compartment temperature section of the Main Display will show “dF”. The setpoint will continue to be displayed on the left side. Compartment temperature will not be displayed during Defrost. The CSMV will always be 100% open during Defrost Mode.

NOTE

The unit will operate in high speed in the defrost mode except during pump down in high ambient defrost.

Defrost Initiation

Before a defrost cycle can be initiated, DTT2 (Defrost Termination Temperature sensor) and SAT (Supply Air Temperature sensor) must be below 40°F (4.4°C) or SAT must be below 45°F (7.2°C). If the DTT2 and SAT alarms are active, then the RAT (Return Air Temperature sensor) must be below 45°F (7.2°C). Once the temperatures are below these values defrost may be initiated by any of three different methods:

a. Defrost Interval Timer: The microprocessor contains an internal Defrost Timer (adjustable in the Functional Parameter list) which can be set using the keyboard (Refer to Section 3.15 Functional Change) The Defrost Timer may be set for 1.5, 3.0, 6.0, or 12.0 hour intervals. When the unit has run for the selectedamount of time a defrost cycle will be initiated .The Defrost Timer is reset to zero whenever a defrost cycle ends(regardless of how it was initiated), and begins counting down until the next defrost cycle. The microprocessor holds in memory the last entered Defrost Timer interval.

   The Defrost Timer increments (counts) time only when the engine and compressor are running and the DTT2 is below 40°F (4.4°C) or the SAT is below 45°F (7.2°C). When the START/RUN-OFF switch is turned off, the defrost timer will be reset to zero. Units running in Start-Stop will not increment the timer during off cycles. For this reason, the defrost timer can not attempt to initiate a defrost cycle during an off cycle. However, it is possible that the unit will go into a defrost cycle very shortly after restarting from a Start/Stop Off Cycle, if the timer expires then.

b. Defrost Air Switch: A Defrost Air Switch (DAS) measures the air restriction through the evaporator coil. As ice forms and builds up, the air flow is restricted. Once enough ice builds up, the switch contacts will close, and initiate a defrost cycle. The Defrost Air Switch requires periodic testing and calibration. (Refer to Section 8.26) In the case where the switch is out of adjustment, it will either not put the unit into defrost as soon as needed, or it will attempt to put the unit into defrost prematurely. In the first case, the defrost timer will help correct any icing problem.

TIP

Ice is not the only thing that will cause the air differential to increase across the evaporator coil. Shrink wrap, paper, plastic bags, and other such items when caught in the return air stream and pulled up against the evaporator coil or the return air grill can also cause the Defrost Air Switch contacts to close.

When looking at a unit for a Defrost Air Switch problem, be sure to also inspect the condition and cleanliness of the evaporator coil, and the return air area.

c.Manual Defrost : The Defrost cycle may be started at any time (providing that the DTT2 and SAT temperatures are below the range defined above) by pushing the MANUAL DEFROST key (Refer to Section 3.9).

Normal Defrost Operation

SV1	SV2	SV4	SCS	Clutch Output	UL1	UL2	CSMV
CLOSE (energized)	Refer to SV2 Operation	OPEN (energized)	HIGH	DISENGAGE (de-energized)	LOAD (de-energized)	LOAD (de-energized)	100% Open

When the ambient air temperature is greater than 35°F (1.7°C) the compressor discharge pressure will be monitored during the defrost cycle:

NOTE

If the Ambient Air temperature is below 80°F (26.7°C) the Normal Defrost Operation will be used. When the Ambient Air temperature is above 80°F (26.7°C), the High Ambient Defrost Operation will be used .

If the discharge pressure rises to 340 psig (23.1 Bar), UL1 will energize and unload for the remainder of the defrost cycle.

If the discharge pressure rises to 350 psig, the SV1 valve will de-energize (open) for 1 second to reduce the discharge pressure. If the discharge pressure remains at 350 psig (23.8 Bar), the SV1 valve may de-energize (open) again ad much as twice a minute.

Normal Defrost Termination

Defrost Termination: Defrost will be terminated once any of the following conditions are met:

a.When the defrost termination temperature (DTT2) and Supply Air Temperature (SAT) **are both** above 55°F (12.8°C) and the sensors are working properly. If both DTT2 and SAT sensors are bad, then defrost will terminate in 10 minutes. A sensor alarm indicates that the sensor is bad.

b. Defrost Terminated By Time Alarm. The microprocessor also has a Defrost Cycle Timer which monitors the total time of the Defrost cycle. This is the amount of time that the system is actually defrosting. This timer starts every time a Defrost Cycle is initiated. It is used to terminate Defrost after a maximum time of 45 minutes. If the Defrost cycle does not complete within 45 minutes, the following will occur:

- The Defrost cycle will be terminated.
- Defrost Override timer is activated which will initiate another defrost cycle in 1.5 hours, regardless of the standard Defrost Timer setting.
- A54 DEFROST NOT COMPLETE Alarm will be activated

NOTE

If the Defrost Air Switch (DAS) contacts are still closed at defrost termination or if the DAS calls for a defrost cycle within eight minutes of the previous defrost cycle termination in two consecutive defrost cycles, the following will occur.

- The Defrost Air Switch (DAS) is ignored for defrost initiation, until the unit has completed another defrost cycle in which the DAS contacts were open at termination. (The manual defrost switch can always start a new Defrost cycle.)
- A55 CHECK DEFROST AIR SWITCH Alarm is activated.
- A Defrost Override timer is activated which will initiate another defrost cycle in 1.5 hours, regardless of the standard Defrost Timer setting.

Normal Defrost Termination Sequence

The following sequence will be used to perform a Normal Defrost Termination:

a. The micro will place the engine in Low Speed and Open (de-energize) SV1 and Open (energize) SV2 and SV4.

b. The micro will return the CSMV to the same % it was prior to the initiation of defrost.

c.The SV4 will close (de-energize) .

d. After a few seconds the Clutch will be engaged (energized). There will be a short delay before the engine can return to High Speed.

e. At this point, the microprocessor will return to normal temperature control. (The data recorder will record a Defrost Termination Event)

High Ambient Defrost Operation

NOTE

If the Ambient Air temperature is below 80°F (26.7°C) then the Normal Defrost Operation will be used. When the Ambient Air temperature is above 80°F (26.7°C), the High Ambient Defrost Operation will be used.

If the discharge pressure rises to 340 psig (23.1 Bar), UL1 will energize and unload for the remainder of the defrost cycle.

If the discharge pressure rises to 350 psig, the SV1 valve will de-energize (open) for 1 second to reduce the discharge pressure. If the discharge pressure remains at 350 psig (23.8 Bar), the SV1 valve may de-energize (open) again ad much as twice a minute.

The High Ambient Defrost Cycle has three separate modes:

a. Pump Down Mode – The Pump Down Mode pumps the low side of the refrigeration system down to a lower suction pressure, and reduces the engine load normally seen at the beginning of a Defrost Cycle.

SV1	SV2	SV4	Engine Speed	Clutch Output	UL1	UL2	CSMV
OPEN (de-energized)	CLOSE (de-energize)	CLOSE (de-energize)	LOW (de-energize)	ENGAGE (energized)	UNLOAD (energized)	UNLOAD (energized)	100% Open

The unit will remain in the Pump Down Mode until the following conditions are met:

- A minimum of 30 seconds, and the suction pressure is less than 10 PSIG (0.68 Bar) or OR
- A maximum of 5 1/2 minutes, regardless of suction pressure.

b. High Ambient Defrost Mode – Following the Pump Down Mode, the Defrost Cycle will begin. The unit controls will be opened/closed as follows:

SV1	SV2	SV4	Engine Speed	Clutch Output	UL1	UL2	CSMV
CLOSE (energized)	Refer to SV2 Operation	OPEN (energized)	HIGH (de-energized)	DISENGAGE (de-energized)	UNLOAD (de-energized	LOAD (energized)	100% Open

c.High Ambient Defrost Termination – Once the Defrost Termination Temperature Sensor (DTT2) and Supply Air Temperature (SAT) reach 55°F (12.8°C), the high ambient defrost cycle will terminate.

High Ambient Defrost Termination Sequence

The following sequence will be used for High Ambient Defrost Termination.

- The unit will remain in High Speed and will reset the CSMV position to the position it was in at the start of defrost.
- The microprocessor will open (de-energize) SV1 and open (energize) SV2 and unload (energize) UL1.
- When suction pressure has risen 10 PSIG (0.7 Bar) above start point or after 15 seconds, the microprocessor will place the unit in Low Speed, close (de-energize) SV4, and unload (energize) UL2.
- After 5 seconds, the clutch will be engaged.
- After an additional 5 seconds, the microprocessor will return to normal temperature control. (The data recorder will record a Defrost Termination Event)

NOTE

If the Ambient Air temperature is below 80°F (26.7°C) then the Normal Defrost Operation will be used. When the Ambient Air temperature is above 80°F (26.7°C), the High Ambient Defrost Operation will be used.

High Ambient Defrost Termination

Once the Defrost Termination Temperature Sensor (DTT2) and Supply Air Temperature (SAT) reach 55°F (12.8°C), the defrost cycle will terminate.

High Ambient Defrost Termination Sequence

The following sequence will be used for High Ambient Defrost Termination.

a.The unit will remain in High Speed and will reset the CSMV position to the position it was in at the start of defrost.

b.The microprocessor will open (de-energize) SV1 and open (energize) SV2 and unload (energize) UL1.

c.When suction pressure has risen 10 PSIG (0.68 Bar) above start point or after 15 seconds, the microprocessor will place the unit in Low Speed, close (de–energize) SV4, and unload (energize) UL2.

d.After 5 seconds, the clutch will be engaged.

e.After an additional 5 seconds, the microprocessor will return to normal temperature control. (The data recorder will record a Defrost Termination Event)

NOTE

Refer to Section 2.14 for more on the defrost mode.

4.4.9 Unloader Control Operation

To "LOAD," or de-energize, a compressor unloader increases the capacity of the system by increasing the number of cylinders pumping refrigerant in the compressor. To "UNLOAD," or energize, a compressor unloader decreases the capacity of the system by decreasing the number of cylinders pumping refrigerant. Refer to Section 2.3.3 for more information on compressor unloaders.

Unloaders will use the differences of Controlling Temperature and setpoint, as follows:

Mode	LOAD (de-energize) UL1 and UL2	UNLOAD (energize) UL1 and UL2
COOL (Perishable)	Control Temp is more than 3.6°F (2°C) above setpoint	Control Temp is less than 2.3°F (1.3°C) above setpoint
HEAT	Control Temp is more than 2.7°F (1.5°C) below setpoint	Control Temp is less than 2.3°F (1.3°C) below setpoint
COOL (Frozen)	Control Temp is more than 3.6°F (2°C) above setpoint	Control Temp is less than 1.4°F (0.8°C) above setpoint

When the compressor is fully loaded, it is operating on six cylinders. When the front unloader UL1 is Unloaded (energized), the unit operates on four cylinders. When UL1 and the rear unloader UL2 are both unloaded (energized), the unit operates on two cylinders. UL2 always unloads before UL1.

4.4.10SV1 Operation :

The SV1 valve will be open (de–energized) whenever the system is operating in the Cool Cycle.The SV1 valve will be closed (energized) during Heat and Defrost Cycles. When the system is operating in the Defrost Cycle, and the Discharge Pressure reaches 350 PSIG (23.8 Bars) during Defrost, SV1 opens (de–energizes) for 1 second then closes (energizes) again to help control Discharge Pressure.

4.5SV2 Operation :

The SV2 valve will be open (energized) whenever the system is operating in the Cool Cycle. The SV2 valve will open and close during the Heat and Defrost Cycles to control Discharge and Suction pressures.

The following SV2 control is used during the Heat and Defrost cycles:

1. If the Discharge Pressure is greater than the SV2 closed value shown in the table below, SV2 is de–energized (closed).

2. If the Discharge Pressure is less than the SV2 open value, SV2 is energized (open).

SV2 closed and open pressure settings are based on the model number as follows:

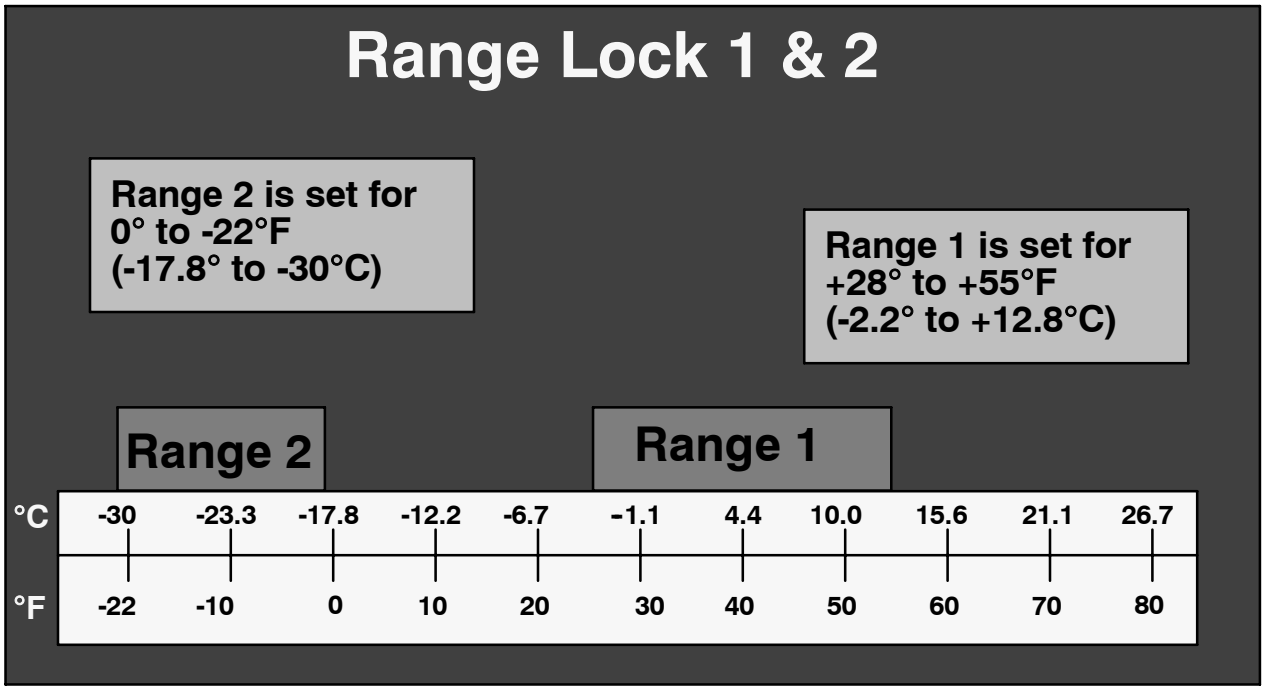
Model No.	SV2 OPEN	SV2 CLOSE
Ultima XTC and X2 2500	190 PSIG (12.9 Bars)	250 PSIG (17 Bars)
Ultra XTC and X2 2100	200 PSIG (13.6 Bars)	300 PSIG (20.4 Bars)

4.5.1 Temperature Range Lock 1 & 2

The unit can be locked into Start-Stop or Continuous Run operation for various setpoints. Two ranges are available for setpoint range lock selection. Each Range can be independently set to lock it's setpoint temperatures into either Start-Stop or Continuous Run.

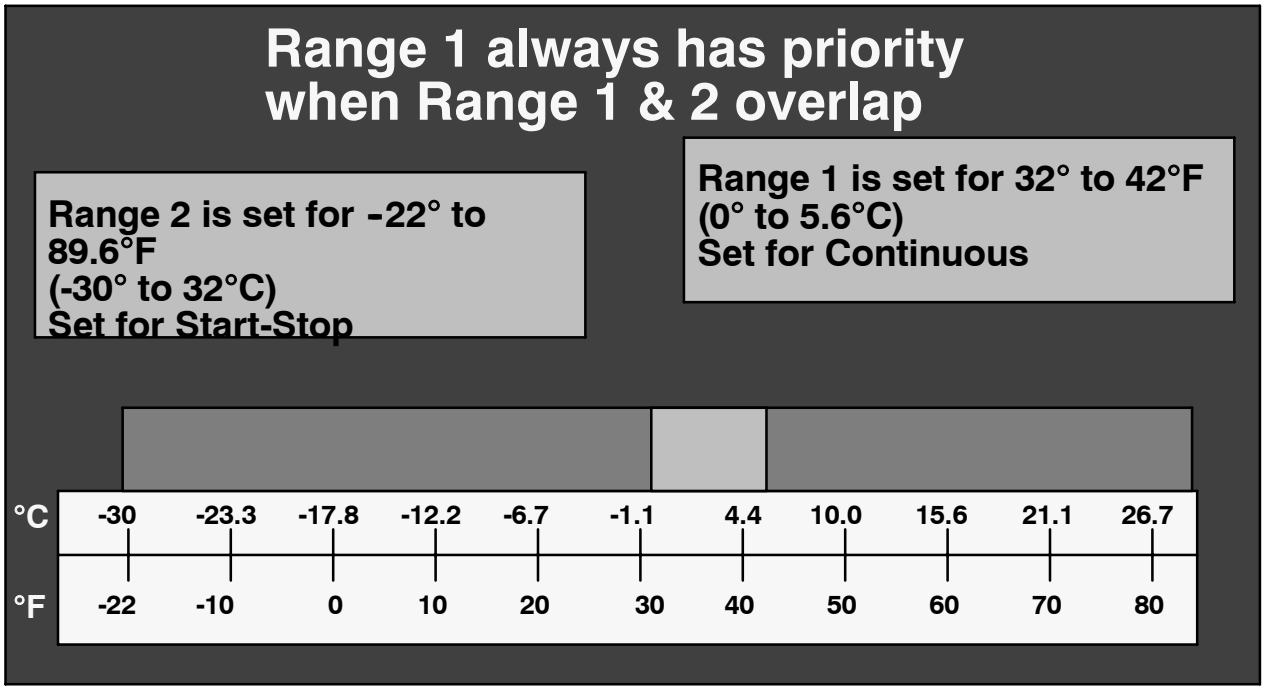
Each Range has its own selectable minimum and maximum temperatures, which define the span of the range. If some setpoint temperatures are contained in both ranges due to range overlap, Range 1 will always have priority over Range 2.

For example (refer to following figure), if Continuous Run operation is ALWAYS required whenever the setpoint is between +28°F and +55°F (-2.2°C and -12.8°C), Range 1 will be set for Continuous Run, with a Minimum Temperature of +28°F (-2.2°C) and a Maximum Temperature of +55°F (-12.8°C). Should Continuous Run operation ALWAYS also be required with setpoints between -22°F (-30°C) and 0°F (-17.8°C), then Range 2 will be set for Continuous Run, with a Minimum Temperature of -22°F (-30°C) and a Maximum Temperature of 0°F (-17.8°C). Any setpoint outside of Range 1 or 2 will allow changes between Start-Stop and Continuous Run.



In the same example as above, Range 1 or Range 2 can be changed to lock the unit operation into Start-Stop. The primary time that it is important to determine which range is to be Range 1 and which is to be Range 2 is when the ranges overlap each other.

In example 2 (Refer to Figure below), the ranges will be set to lock all setpoints into Start-Stop, except for a small range between 0° and 5.6°C (+32° and +42°F) where the unit will always operate in Continuous Run. Range 1 Minimum Temperature will be set for 0°C (+32°F), and Maximum Temperature of 5.6°C (+42°F). Range 2 will be set for a Minimum Temperature of -30°C (-22°F) and a Maximum Temperature of 32°C (+89.6°F).



4.5.2 ProductShield™

ProductShield is a group of configuration settings within the microprocessor that work together with the IntelliSet option to allow improved operating efficiency while providing customized product protection for up to 31 different commodities.

There are three modes to ProductShield:

a. ProductShield: Econo

ProductShield Econo allows the unit to have the ability to automatically switch from Start/Stop operation to Continuous run or vice versa. This allows maximum product protection while providing for fuel savings depending on ambient conditions.

When the unit is set for Continuous Run, ProductShield Econo allows the unit to run in Start/Stop when:

- ProductShield Econo configuration is set to GO TO S/S (See Section 5.2.1) **AND**
- The unit has run in Continuous Run for a minimum of either15 minutes, or the Minimum Run Time as selected in the Functional Parameter list (whichever time is longer) **AND**
- The ambient temperature falls **within** a pre-programmed temperature range **AND**
- The unit is not already running in ProductShield Winter mode (See Section c. below).

The operator can also optionally pre-program a maximum evaporator coil temperature differential (delta-t) between the return air and supply air sensors as an additional criteria for switching to Start/Stop if the Econo Delta-T configuration is NOT OFF. The unit must bring the delta-t below this setting before going to Start/Stop if this option is chosen. By setting this value for a relatively low temperature [4 to 6°F (2.2 to 3.3°C)] once the delta-T reaches this level the indications are that the product is probably cooled close to setpoint, as the unit is producing a low delta-T which is an indication that not much heat is being removed in order to maintain the Return Air Temperature. By setting this value for a higher value (8 - 15F) or by leaving the setting OFF, the unit will be able to cycle into an Off Cycle regardless if the unit is cooling at a higher capacity or not.

NOTE

If the unit is set for Continuous Run and ProductShield Econo is configured for GO TO CONTINUOUS, the unit will remain in Continuous Run.

Once the micro detects that the above criteria have been met, the unit will switch from Continuous Run to a Start/Stop Off Cycle for the minimum run time as set in the Functional Parameter list. During the Minimum Run Time, the Restart Override Temperature can cause the unit to restart to protect the load temperature. After the minimum run time has expired the unit will return to Continuous Run once the Return Air temperature is more than ±3.6° F (±2° C) away from setpoint.

If the unit shuts down in Auto Start/Stop, it will remain shut down according to the pre-programmed start/stop parameters. When the unit restarts, it will return to Continuous Run operation for a minimum of 15 minutes or the Minimum Run Time (as selected in the Functional Parameter list), whichever time is longer. The original activation conditions must then be met in order for the unit to return to ProductShield Econo: Go to Start/Stop. While the unit is running, the FreshProtect settings (as selected in the Functional Parameter list) will be effective.

When ProductShield Econo Max Temp is set for OFF, and ProductShield Econo Min Temp is set for a temperature, the ambient air temperature will be considered to be “inside the range” whenever the ambient air temperature is higher than the Min Temp setting, with no upper limit.

When ProductShield Econo Max Temp is set for a temperature, and ProductShield Econo Min Temp is set for OFF, the ambient air temperature will be considered to be “inside the range” whenever the ambient air temperature is lower than the Max Temp setting, with no lower limit.

When ProductShield Econo Max Temp is set for OFF, and ProductShield Econo Min Temp is set for OFF, the ambient air temperature will be considered to be “inside the range” at any ambient air temperature.

When the unit is set for Start/Stop, ProductShield Econo allows the unit to run in Continuous Run when:

- ProductShield Econo configuration is set to GO TO CONTINUOUS (See Section 5.2.1), **AND**
- The unit has run in Start/Stop for a minimum of 15 minutes OR the Minimum Run Time, whichever is longer as set in the Functional Parameter list. (See Section Table 3-3) **AND**
- The ambient temperature falls outside a pre-programmed temperature range and the ProductShield Winter ambient condition is not met. (See Section c. below)

NOTE

If unit is set for Start/Stop and ProductShield Econo is configured for GO TO START/STOP, the unit will remain in Start/Stop.

Once the micro detects that the above criteria have been met, the unit will switch from Start/Stop to Continuous Run for a minimum of 30 minutes. After 30 minutes the unit will return to Start/Stop after the ambient temperature has fallen within the pre-programmed temperature range by ±3.6° F (±2° C).

NOTE

Delta-t logic is not used or available when unit is configured for GO TO CONTINUOUS.

b. ProductShield: High Air

High air mode allows the unit to provide increased airflow generally with a reduced delta-T under the pre-programmed criteria. This can maximize product protection under difficult conditions while allowing the unit to operate more efficiently during less demanding conditions.

When the Air Flow parameter (in the Functional Parameter list) is set for NORMAL , ProductShield High Air allows the unit to run at normal (High Speed or Low Speed depending on how far the compartment temperature is away from set point) as long as the ambient air temperature is inside the pre-programmed temperature range.

When the ambient temperature falls outside the pre-programmed temperature range, ProductShield High Air mode will be enabled, and the engine will go to high speed to provide high air flow within the refrigerated compartment.

The operator can also optionally pre-program a maximum evaporator coil temperature differential (delta-t) between the return air and supply air sensors as an additional criteria for switching to high air. When the delta-T setting is used, the unit must bring the delta-t above this setting before going to High Air Mode. The delta-T setting is used to prevent ProductShield High Air from operating when the heat load on the refrigeration unit is low.

- The ProductShield High Air ambient air temperature range is defined by the High Air Max Temp and the High Air Min Temp. When both of these configurations (Refer to Section 5.2.1 for configuration list) are set for a value, the unit will operate as described above.
- When ProductShield High Air Max Temp is set for a value, and High Air Min Temp is set for OFF, ProudctShield High Air mode will only be allowed for temperatures above the High Air Max setting.
- When ProductShield High Air Max Temp is set for OFF, and High Air Min Temp is set for a value, ProudctShield High Air mode will only be allowed for temperatures below the High Air Min setting.
- When both ProductShield High Air Max and Min Temps are set to OFF, ProductShield High Air will not operate at any ambient air temperature.

Once the micro detects that the pre-programmed criteria have been met, the unit will switch from normal operation to High Air. The unit will continue to operate at High Air for a minimum of 30 minutes. After 30 minutes the unit will return to normal operation if the ambient temperature falls inside the pre-programmed temperature range by ±3.6° F (±2° C).

If the unit shuts down in Auto Start/Stop during High Air, it will not be in High Air when it restarts and will return to normal operation for a minimum of 15 minutes. The original activation conditions must then be met in order for the unit to return to high air.

c. ProductShield: Winter

When the unit is set for Start/Stop operation, ProductShield Winter allows it to switch to continuous run when the ambient temperature falls below a pre-programmed temperature. This helps protect the unit from the possibility of fuel gelling and other cold weather issues.

NOTE

ProductShield Winter mode is not available when the unit is operating in Continuous Run.

Once the micro detects that the ambient temperature has dropped below the pre-programmed temperature, the unit will switch into ProductShield Winter mode which will **force** the unit to operate in Continuous Run. The unit will continue to operate in Continuous Run for a minimum of 30 minutes. After 30 minutes, the unit will return to auto Start/Stop if the ambient temperature has risen more than 3.6° F (2° C) above the pre-programmed ProductShield Winter temperature.

All of the ProductShield settings may be viewed in the Data List (Refer to Section 3.13). For units with IntelliSets, the Data List will reflect the ProductShield settings for the IntelliSet that is currently active.

NOTE

ProductShield does not operate within Sleep Mode.

4.5.3 ProductShield Temperature Ranges

Each ProductShield setting allows the user to select an ambient temperature range in which to operate. The Minimum and Maximum range values can be set to OFF, or any value from -20 to +119°F (-28.9 to +48.4°C). The examples below all use the same settings and illustrate the differences in unit operation for the various ProductShield selections.

a. ProductShield: Econo: Go To Start/Stop **Examples** – requires that the ambient temperature go INSIDE the range in order for ProductShield mode to be activated.

The following examples apply in situations where all other Start/Stop conditions have been met.

1. If the Minimum is set to 30°F (-1.1°C) and the Maximum is set to 40°F (4.4°C) and the *ambient air* temperature falls **between** these temperatures, the unit operation can change to Econo Start/Stop.

2. If the Minimum is set to 30°F (-1.1°C) and the Maximum is set to OFF and the *ambient air* temperature is **above** 30°F (-1.1°C), the unit operation can change to Econo Start/Stop.

3. If the Minimum is set to OFF and the Maximum is set to 40°F (4.4°C) and the *ambient air* temperature falls **below** 40°F (1.7°C), the unit operation can change to Econo Start/Stop.

4. If both the Min and the Max are set to OFF, unit operation can change to Econo Start/Stop at any ambient temperature.

b. ProductShield: Econo: Go To Continuous Run and ProductShield High Air **Examples**. Both require that the ambient temperature go OUTSIDE the range in order for ProduceShield mode to be activated.

1. If the Minimum is set to 0°F (-17.8°C) and the Maximum is set to 90°F (32.2°C) and the *ambient air* temperature falls **outside** these temperatures, the unit operation can change to Econo Continuous Run or High Air.

2. If the Minimum is set to 0°F (-17.8°C) and the Maximum is set to OFF and the *ambient air* temperature falls **below** 0°F (-17.8°C), the unit operation can change to Econo Continuous Run or High Air.

3. If the Minimum is set to OFF and the Maximum is set to 90°F (32.2°C) and the *ambient air* temperature falls **above** 90°F (32.2°C), the unit operation can change to Econo Continuous Run or High Air.

4. If both the Min and the Max are set to OFF, ProductShield Econo: Go To Cont and ProductShield High air can not operate as there is no range for the ambient to fall outside of.

c. ProductShield: Delta-T **Examples** – Settings can be used for ProductShield Econo: Go to Start/Stop and ProductShield High Air. When OFF is selected, delta-T is not used as criteria for entering into one of the ProductShield modes. When a value is selected for delta-T, the delta-T will be used in addition to the ambient temperature range in determining when to allow the unit to go into a ProductShield mode.

1. In ProductShield Econo: Go to Start/Stop, the delta-T must be **lower** than the value selected in order to enter the mode.
2. In ProductShield High Air, the delta-T must be **higher** than the value selected in order to enter the mode.
3. Delta-T settings are not used with ProductShield Econo: Go to Continuous Run.

4.5.4 FreshProtect™ Supply Air Control

FreshProtect operates between setpoints of +32.0°F (0° C)and 65.1°F (18.4° C) **only**.

When the unit is operating in Start-Stop, FreshProtect is only functional after the Return Air Temperature is within 0.5 °F of setpoint, and criteria for shutdown other than compartment temperature has not yet been reached.

When the unit is operating in **Continuous Run**, FreshProtect becomes functional once the Return Air Temperature (RAT) is approximately 10°F (5.6°C) above setpoint.

NOTE

FreshProtect only operates when the unit is set for Return Air Control. (See Table 3-3 for more information on setting controls.) It does not operate when the unit is in Supply Air Control nor when the unit is in Heat or Defrost cycles.

FreshProtect places a flexible limit on how far below setpoint the SAT can drop while the unit is operating in Cool Mode. Table 4-3 below shows the functional parameter settings and the corresponding ranges below setpoint that the Supply Air Temperature can go, when the RAT is 10°F (5.6°C) or less above setpoint. Whenever the RAT is more than 10°F (5.6°C) above setpoint, it is possible for the SAT to be lower than the shown range since the air temperature within the cargo area is a considerable distance from its desired point and additional cooling capacity is required.

Table 4-3: FreshProtect
For Return Air Temperatures less than 10°F (5.6° C) above set point.

FreshProtect Setting	Supply Air Range (Below Setpoint)
A	2 TO 5°F (1.1 TO 2.8°C)
B	4 TO 7°F (2.2 TO 3.9°C
C	6 to 9°F (3.3 TO 5.0° C
D	8 to 11°F (4.4 TO 6.1 ° C
E	10 to 13°F (5.6 TO 7.2° C)
OFF	NO LIMIT

The process of refrigeration causes the cargo area air to be drawn into the Return Air inlet of the evaporator section. From there it is directed through the evaporator coil, where it is cooled off, then discharged through the Supply Air blower housing, and back into the cargo area. The warmer the Return Air temperature is in relationship to setpoint, the more cooling capacity is needed to bring the air temperature down to setpoint. As cooling capacity is increased, the Supply Air temperature drops, as additional heat is removed from the air. If left uncontrolled, the Supply Air temperature can fall as much as 20°F (11.1°C) or more below the Return Air temperature.

When the RAT approaches setpoint, the SAT will also approach setpoint. The SAT may then be closer to setpoint than shown in Table 4-3.

When FreshProtect is set for OFF, the system runs with FreshProtect off, and the SAT will operate as far below setpoint as needed to bring the RAT to setpoint as quickly as possible. All other FreshProtect settings enable FreshProtect Supply Air Temperature control, and the controller watches the Supply Air Temperature as well as the Return Air Temperature while the system is operating in the Cool Mode.

4.6 OUTPUT OVERRIDES

4.6.1 Speed Control Solenoid (SCS) Overrides

Speed Control Solenoid Overrides in priority order:

a. High Ambient:

If ambient temperature is 120°F (48.9°C) or above, the unit will run in low speed for a minimum of 2 minutes and until the ambient drops below 110°F (43.3°C). *This applies to Heat and Cool modes only - not Defrost.*

b. Low Suction Pressure/High Discharge Pressure:

If UL1 has been energized (unloaded) and the suction pressure is less than 0 PSIG/Bar for at least 30 seconds or the discharge pressure is greater than 435 PSIG (29.6 Bars) for more than five seconds, the engine will be forced to run in low speed for a minimum of five minutes. After five minutes, the engine can return to high speed if suction pressure is greater than 5 PSIG (0.34 Bar) for 30 seconds or discharge pressure is less than 410 PSIG (28.0 Bar) for 30 seconds.

c. Low Speed Engine Coolant Warm-up:

If engine Coolant Temperature Sensor Alarm is not active the engine will run in low speed until the coolant is above 79°F (26°C).

The engine will run in low speed (while the engine warms up) until the coolant is above 79°F (26°C).

d. Defrost:

The unit Is generally in High Speed but will run in low speed during Stage 1 (pump-down mode) of High Ambient Defrost. It will also run at low speed at the end of the defrost cycle when the clutch is re-engaged

e. Door/Remote Switch Configurable for Low Speed Alarm:

The unit will be forced into low speed if the (optional) door switch, Remote Switch 1, or Remote Switch 2 alarm is active and is configured for the unit to operate in Low Speed when the door is open

f. Cargo Protect Mode:

If the setpoint is in the frozen range i.e. below +10.4°F (-12°C), and both RAT and SAT sensor alarms are active, the unit will run in low speed cool.

g. Frozen Setpoint:

If the setpoint is in the frozen range i.e. below +10.4°F (-12°C), and the refrigerated compartment temperature is below setpoint, the unit will run in low speed

h. High Air Flow:

For Perishable setpoints, the AIR FLOW Functional Parameter will force the unit to operate in continuous High Speed operation when AIR FLOW: HIGH is selected. (When AIR FLOW: NORMAL is selected, the unit will cycle normally between high and low speeds.) High Air is NOT available for setpoints in the frozen range i.e. below +10.4°F (-12°C).

i. Product Shield High Air:

The engine is forced to High Speed if Product Shield High Air Configuration is set to “ON” and the ambient temperature falls outside the selected range and the temperature difference between the supply air and the return air is greater than the selected value (see Section 4.5.2 for more information on Product Shield).

j. Adjustable High Speed Delay on Engine Start-up:

Whenever the engine starts, the unit will remain in low speed according to the selection made in the Functional Parameter list for High Speed Delay for Continuous or Start-Stop modes. A different setting is allowed for each mode. (Refer to Functional Parameters, Section 3.15. for additional information)

k. Start-Stop Frozen Range:

In Start-Stop Mode with the setpoint in the frozen range i.e. below +10.4°F (-12°C) and minimum run time has expired and the refrigerated compartment temperature is not yet down to setpoint, the engine will be forced to high speed operation.

l. High Speed Delay: When operating in low speed, there is a delay when switching to high speed. The default delay is one minute. Refer to Configuration Mode, Section 5.2.

Whenever the unit is operating in low speed, there may be a delay before switching to high speed. This delay is selected in the Configuration List. (Refer to Configuration Mode, Section 5.2.)

4.6.2 Unloader Control Priority (UL1 & UL2)

The compressor unloaders will operate in either a de-energized (loaded) or energized (unloaded) position, depending on current operating conditions. The list below shows the conditions that will control the operation of the unloaders in addition to the unloader control used by the temperature control described in section 4.4.9.

There is a delay of 10 seconds between LOADING (de-energizing) compressor cylinders under all operating conditions except engine starting.

The overrides will be allowed in Cargo Protect Mode if the override does not use the return or supply temperature.

Unloader Overrides in priority order. If an override only applies or takes effect for one unloader, continue down the priority list for the other unloader:

a. High Ambient:

If the ambient temperature is above 120°F (48.9°C) when the engine starts UL1 and UL2 will both be unloaded for a minimum of 2 minutes and until the ambient air temperature drops below 110°F (43.3°C)

b. Mop Override, Maximum Operating Pressure Control:

UL1 and UL2 will be energized and de-energized based on Compressor Suction Pressure (CSP). Refer to MOP Override Section 4.8

If the unit is operating in Defrost or in HEAT, the MOP Override can only UNLOAD the UL1. The UL2 must remain LOADED.

c. Low Suction Pressure/High Discharge Pressure:

Unloading is used along with low speed to increase the suction pressure or decrease the discharge pressure. These steps in capacity reduction are taken in the following order: 6-cylinder high speed to 4-cylinder high speed to 4-cylinder low speed to 2-cylinder low speed. Unloading will take place if the following conditions occur: discharge pressure is greater than 435 PSIG (29.6 Bars) for 5 seconds or suction pressure is less than 0 PSIG (0Bar) for 30 seconds.

Therefore, if the engine is running at high speed 6 cylinder operation and one of the conditions listed above occurs, the compressor will be unloaded from 6 to 4 cylinders (UL1 will be energized) and the engine will remain in high speed. If the condition (discharge pressure greater than 435 PSIG or suction pressure less than 0 PSIG) does not change to at least a drop in discharge pressure to less than 410 PSIG or an increase in suction pressure to above 5 PSIG, the engine will shift to low speed and the compressor will remain running on 4 cylinders). If the condition still does not change, UL2 will energize and the compressor will operate on 2 cylinders, still in low speed operation. Once the engine shifts to low speed, or one or both of the unloaders energize due to these conditions the unit will remain in low speed, and the unloader(s) will remain energized for a minimum of 5 minutes.

d. Defrost: Refer to defrost control (Refer to Section 4.4.8).

In a Normal Defrost cycle, both unloaders will be loaded (de-energized).

In a High Ambient Defrost Cycle, both unloaders will be unloaded (energized) during the Stage 1 pumpdown mode. The remainder of the Defrost Cycle will have UL1 unloaded (energized) and UL2 loaded (de-energized).

e. Cargo Protect Mode:

If the setpoint is in the frozen range [below +10.4°F (-12°C)] and both RAT and SAT sensor alarms are active, the unit will run fully loaded (UL1 and UL2 de-energized).

f. Start/Stop Override:

If the system is running in Start/Stop-Run Mode, and the minimum run time has expired and the compartment temperature is not at setpoint, and the Return Air Temperature is less than 50°F (10°C), both unloaders will be LOADED (de-energized) to increase the unit capacity so that set point may be reached more quickly, and allow an Off Cycle.

g. Continuous Run Low Speed Null Mode: UL1 and UL2 will load and unload periodically as the control system makes adjustments in the system's capacity to maintain compartment temperature when it is close to setpoint.

4.7 MAXIMUM SUCTION OPERATING PRESSURE (COOL ONLY)

In Cool Mode, the CSMV is used to control Suction Pressure to these **MAXIMUM** operating limits determined by the compressor speed and number of loaded cylinders, as shown in the following table. Pressures may be lower depending on ambient and control temperatures, etc.

Table 4-4 Suction MOP

Model	Ambient Air Temperatures below 108.5°F (42.5°C)			Ambient Air Temperatures above 110.3°F (43.5°C)		
	6 Cylinders	4 Cylinders	2 Cylinders	6 Cylinders	4 Cylinders	2 Cylinders
Ultima XTC and X2 2500 High Speed	25 PSIG (1.7 Bars)	40 PSIG (2.7 Bars)	76 PSIG (5.2 Bars)	19 PSIG (1.3 Bars)	30 PSIG (2.0 Bars)	70 PSIG (4.8 Bars)
Ultima XTC and X2 2500 Low Speed	35 PSIG (2.4 Bars)	50 PSIG (1.5 Bars)	76 PSIG (5.2 Bars)	21 PSIG (1.4 Bars)	35 PSIG (2.4 Bars)	60 PSIG (4.1 Bars)
Ultra XTC and X2 2100 High Speed	31 PSIG (2.1 Bars)	50 PSIG (1.5 Bars)	76 PSIG (5.2 Bars)	20 PSIG (1.4 Bars)	40 PSIG (2.7 Bars)	70 PSIG (4.8 Bars))
Ultra XTC and X2 2100 Low Speed	35 PSIG (2.4 Bars)	50 PSIG (1.5 Bars)	76 PSIG (5.2 Bars)	20 PSIG (1.4 Bars)	30 PSIG (2.0 Bars))	60 PSIG (4.1 Bars)

4.8 MAXIMUM OPERATING PRESSURE (MOP) OVERRIDE (HEAT AND DEFROST ONLY)

The microprocessor monitors the suction pressure of the refrigeration system and controls the unloaders to maintain a Maximum Operating Pressure (MOP). The CSMV is always at 100% open in heat and defrost modes. A Compressor Suction Pressure (CSP) transducer is used to provide this information to the microprocessor. This MOP is calculated based on suction pressure, ambient air temperature, and mode of operation. From this the microprocessor will be able to determine the system load. The system load will correspond to a maximum horse power, discharge pressure and coolant temperature which the unit can operate within. By overriding temperature control and unloading cylinder banks on the compressor, these conditions can be maintained at the appropriate levels.

When the compressor is fully loaded it is operating on six cylinders. When the front unloader UL1 is UNLOADED (energized), the unit operates on four cylinders. When UL1 and the rear unloader UL2 are UNLOADED (energized), the unit operates on two cylinders. The front unloader, UL1, always unloads before the rear unloader, UL2.

4.8.1 Suction Pressure Operation

Directions For Reading the Chart Below

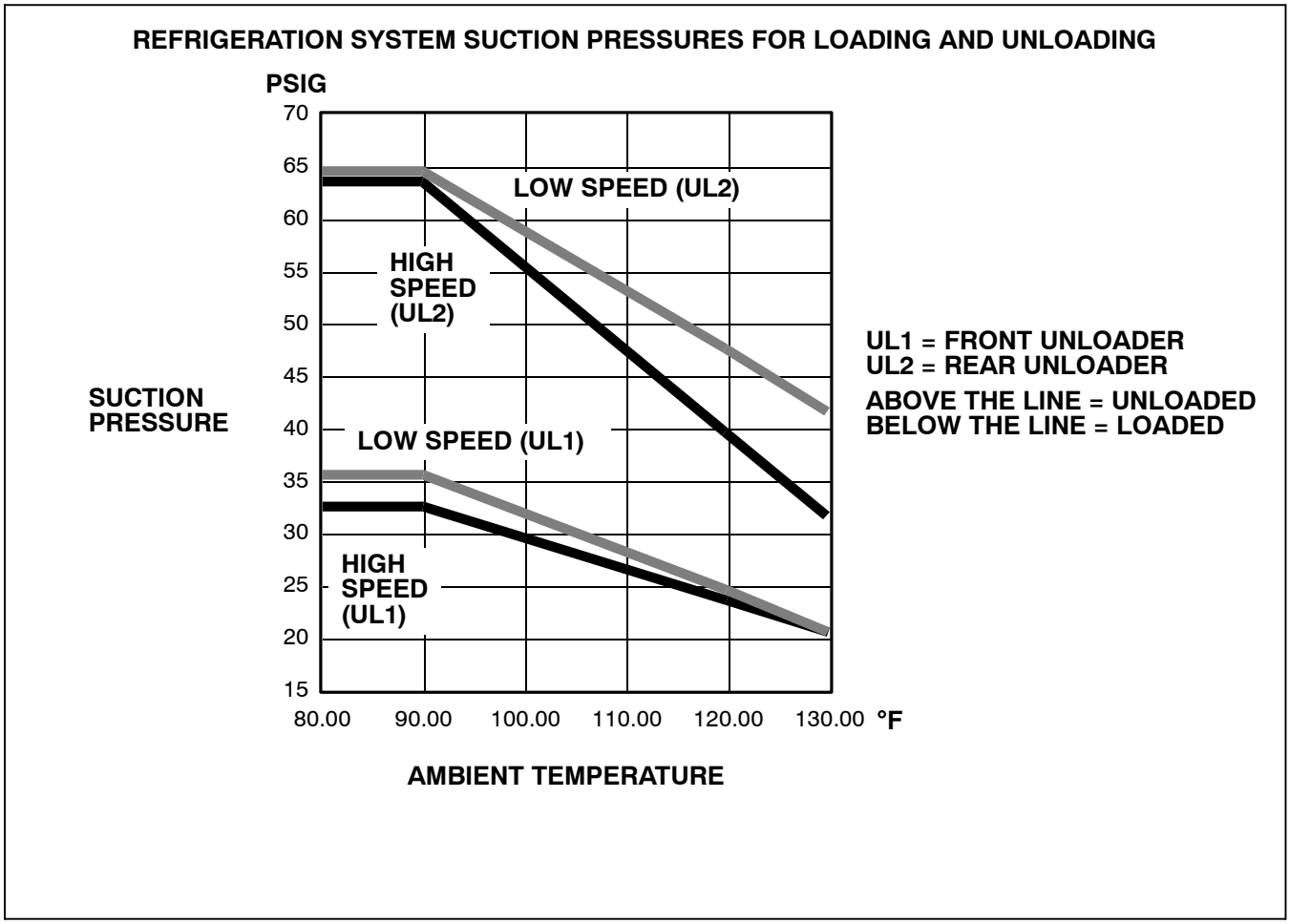
a. At ambient temperatures of 90°F (32.2°C) or below:

When the system is operating in *high speed* and the suction pressure is greater than 63 PSIG (4.3 Bars), both unloaders are unloaded. As the suction pressure drops below 63 PSIG (4.3 Bars), the UL2 unloader is loaded. If the suction pressure drops below 32 PSIG (2.2 Bars), the UL1 unloader is loaded.

When the system is operating in *low speed* and the suction pressure is greater than 65 PSIG (4.4 Bars), both unloaders are unloaded. As the suction pressure drops below 64 PSIG (4.4 Bars), the UL2 unloader is loaded. If the suction pressure drops below 35 PSIG (2.4 Bars), the UL1 unloader is loaded.

b. At ambient temperatures of 90°F (32.2°C) or higher:

At ambient temperatures of 90°F (32.2°C) or higher the unloading suction pressure settings relative to ambient temperatures follow a descending straight line. (Refer to following chart)



SECTION 5

TECHNICIAN INTERFACE

5.1 PC MODE/DOWNLOAD PORT

PC mode allows the user to access and download data using a computer when the unit is not running and without starting the eight-hour DataRecorder timer. Connecting a download cable {(P/N 22-01737-00 (6' Long) or 22-01737-04 (20' Long)} to the download port with the START/RUN-OFF switch in the OFF position allows the Advance Microprocessor to power up and communicate with the computer.

All functions available from the keypad may be viewed or changed using the ReeferManager and a personal computer (PC) connected to the download port. Using the PC will provide additional programming and configuring capabilities that will not be available through the keypad.

The DataRecorder may also be configured and downloaded through the download port using the ReeferManager program.

Some of the things that you may want to use PC mode for are:

- Changing setpoint for the next load
- Changing any of the functional parameters for the next load
- Reading Engine hourmeters
- Reading Maintenance hourmeters
- Resetting Maintenance hourmeters
- Viewing the Active and Inactive alarm lists.
- Entering a Trip Start
- Keeping the microprocessor powered up after turning the START/RUN-OFF switch to the OFF position.
- Demonstrating the operation of the microprocessor without the engine running.
- Use any of the PC cards (Download, Program, Configuration or Option)

To better utilize PC mode, a PC mode jumper (22-50180-01) is available. This looks very similar to the Configuration jumper (refer to Section 5.2), but has a **GREEN WIRE** on it. With the unit off, locate the download port. Remove the protective plug to gain access to the wire terminals. Plug in jumper or connect an ***insulated jumper*** wire to terminals C and E.

If the START/RUN-OFF switch is put into the START/RUN position, the microprocessor will go to normal operation. If the unit is shut down with the PC cable or jumper still in place, the engine will shut down and the microprocessor will remain powered up.

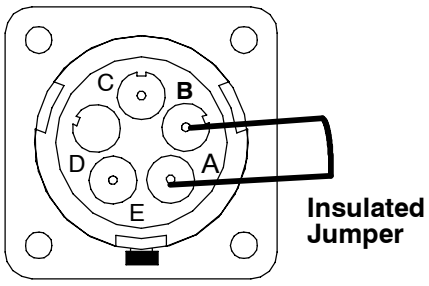
⚠ WARNING

Do not place the START/RUN-OFF Switch in the START/RUN position or the unit will start.

5.2 MICROPROCESSOR CONFIGURATION AND TECHNICIAN TEST MODES (REMOVE JUMPER MODE)

c. Turn the START/RUN-OFF switch to the OFF position.

d. With the unit off, locate the download port. Remove the protective plug to gain access to the wire terminals. Plug in jumper P/N 22-50180-00 or connect an ***insulated jumper*** wire between plug terminals A and B.



Download Port

Jumper P/N 22-50180-00

WARNING
DO NOT ALLOW JUMPER WIRE TO TOUCH ANY GROUND.

e. Turn the START/RUN-OFF switch to the START/-RUN position. The ALARM LED will come on, the set-point will appear, but the refrigerated compartment temperature will not and
"REMOVE JUMPER" will appear in the MessageCenter for 10 seconds. Remove the jumper at this time. ↑ ↓ TO SCROLL, THEN = TO SELECT" will appear in the MessageCenter for 10 seconds or until either the UP or DOWN ARROW keys are pressed.

f. Press the UP ARROW key to scroll through the Main Menu beginning at the top.
Press the DOWN ARROW key to scroll through the Main Menu beginning at the bottom.

g. Select the mode you wish to access and press the = key. See the following pages for information on these test modes:
   - Configuration Mode
   - Component Test Mode
   - Service Mode

5.2.1 Configuration Mode

NOTE

To enter Configuration mode, refer to Section 5.2.

a. "↑ ↓ TO SCROLL, THEN = TO SELECT" will appear in the MessageCenter.

b. Press the UP ARROW key to scroll through the Configuration list beginning at the top.
Press the DOWN ARROW key to scroll through the Configuration list beginning at the bottom.

c. To read through the Configuration list, continue to press either the UP or DOWN ARROW keys. The list is circular, meaning that once the end is reached, it is repeated from the beginning.

d. To change one of the configurations, bring the Configuration to change into the MessageCenter and press "=." ↑ ↓ TO SCROLL, THEN = TO SAVE" will show in the MessageCenter for 10 seconds Then the selected Configuration will flash, showing the current value. Press the UP or DOWN ARROW key to scroll through the list of available selections for this Configuration.

e. Once a new value is showing in the MessageCenter, press the = key to save the selection. The MessageCenter will stop flashing. The new value is now in memory.

f. Press the UP ARROW key to continue to scroll through the Configuration list.

CONFIGURATION	SELECTIONS	DESCRIPTION
UNIT MODEL FAMILY Pick one of these models from the X series model family.	ULTRA XTC, ULTIMA XTC, VECTOR	Units models are grouped into families. The correct family must be identified for the correct model number to be displayed in the next selection.
UNIT MODEL NUMBER* This list contains many selections. Only those covered by this manual are shown here. Pick one of these models from the X series model family.	NDL93N*ABO NDL93P*ABO NDL93R*ABO NDL93S*ABO NDL93S*ABA NDL93U*ABA NDL93V*ABO	The correct model number must be selected for proper operation and control. The model number selected here can be read in the Unit Data list.
UNIT SERIAL NUMBER		The unit S/N may be entered. This may be up to 11 characters long. Numbers, letters, and a space are available by scrolling through the available list.
TRAILER ID #		The ID number may be entered. This may be up to 10 characters long. Numbers, letters, and a space are available by scrolling through the available list.
SET NEW HOURS		Hours from existing micro can be installed into replacement micro. **NOTE:** Changes to these values may be made for up to 60 minutes. This configuration only appears in the list until an hourmeter reaches 25 hours.
GLOW TIME	(LONG / **SHORT**)	LONG = Longer glow times may be used for units in colder ambient conditions. SHORT= Shorter glow times are used as the factory setting for all engines. **NOTE:** Refer to Section 4.1 for glow time table.

CONFIGURATION	SELECTIONS	DESCRIPTION
OUT OF RANGE SHUTDOWN:	YES / **NO**	YES = When the compartment temperature has been out-of-range for 30 minutes, the alarm light will come on, and the unit will shut down. NO = When the compartment temperature has been out-of-range for 15 minutes, the alarm light will come on and the unit will continue to run.
PARAMETERS LOCKOUT:	YES / **NO**	YES = All Functional Parameters in the function list are locked in place. NO = All Functional Parameters in the function list can be changed using the keypad, unless individually locked out by ReeferManager.
RPM ALARM SHUTDOWN:	YES / **NO**	YES = If alarm 39 (Check Engine RPM) is active, turn the alarm light on and shut the engine off. NO = If alarm 39 (Check Engine RPM) is active, turn the alarm light on and allow the unit to continue to run.
LOW PRESSURE SHUTDOWN:	**YES** / NO	YES = When low refrigerant pressure is sensed in the system (alarm 18 is active), turn the alarm light on and shut the unit down (after the time delay in the following selection). NO = When low refrigerant pressure is sensed in the system (alarm 18 is active), turn the alarm light on and the unit will continue to run.
LP SHUTDOWN DELAY:	**120SECS** (0 - 255 seconds)	After the Low Pressure signal is received, how long shall the unit continue to run before it is shut down.
HIGH SUCT PRESS SHUTDOWN	**YES** / NO	YES = If the unit is running and the suction pressure rises to 98 PSIG (6.67 Bars) or higher for 10 minutes (alarm 27 is active), the unit will shut down. NO = High suction pressure will not shut down the unit.
REFRIGERATION SYS SHUTDOWN	**YES** / NO	YES = When the unit is running and the discharge pressure is not at least 5 PSIG (0.34 Bar) higher than the suction pressure (alarm 28 is active), shut the unit down. NO = When the unit is running, do not shut the unit down if the above condition exists.
COMPRESSOR ALARM SHUTDOWN (Special activation required)	YES / **NO**	YES = The unit will shutdown and not restart when alarms 13, 17, 18, 27, 28, 29 or 56 occur three times within two hours. NO = Normal shutdown rules for above alarms.
CURRENT FOR S/S SHUTOFF	**6.5A** 1A TO 10A (in .5A increments)	Charging amps must be lower than this for start--stop off cycle.
VOLTAGE FOR S/S RESTART	**12.2A** 12.0 TO 12.8 VDC (in .5A increments)	This value will be used during START/STOP-OFF cycles. If battery voltage falls below this value, the unit will restart.
ALTERNATOR CHECK SHUTDOWN:	YES / **NO**	YES = When the alternator is not charging (alarm 51 is active), turn the alarm light on and shut the unit down. NO = When the alternator is not charging (alarm 51 is active), turn the alarm light on and the unit will continue to run.
ENGINE OIL LEVEL SWITCH:	YES / **NO**	YES = This unit has a low engine oil level switch installed. NO = This unit does not have a low engine oil level switch installed.

CONFIGURATION	SELECTIONS	DESCRIPTION
LOW COOLANT LEVEL	YES / **NO**	YES = A Low Coolant Level sensor is installed in the coolant system. NO = There is no Low Coolant Level sensor installed in the coolant system.
FUEL TANK	**NO DEVICE** SWITCH INSTALLED 0 TO 100% SENSOR	NO DEVICE = There is no Low Fuel Level sensor installed in the fuel tank. SWITCH INSTALLED = A Low Fuel Level switch is installed in the fuel tank. 0 to 100% SENSOR = A Low Fuel Level sensor is installed in the fuel tank. The fuel level may be read in the unit data list.
FUEL TANK SIZE	**OFF** 30 GALLONS 50 GALLONS 75 GALLONS 100 GALLONS 120 GALLONS	OFF = No Low Fuel Level *Switch* or *0 to 100% Sensor* is installed in the tank; OR A Low Fuel Level *switch* or a *0 to 100% sensor* is installed in the tank, but the unit will not shutdown due to a Low Fuel Level Alarm. 30 - 120 GALLONS = When a Low Fuel Level *switch* is installed and the LOW FUEL LEVEL WARNING (alarm 1) is on, the unit will shutdown (alarm 19) after a time delay (Refer to chart below) 30 gallon – 30 min 50 gallon – 60 min 75 gallon – 90 min 100 gallon – 120 min 120 gallon – 150 min OR If a *0 to 100% sensor* is installed, the low fuel level WARNING (alarm 1) will come on when the level reaches 15% or less and the unit will shutdown (alarm 19) when the level reaches 10%.
DISPLAY TOTAL ENGINE HR	NO / **YES**	YES = This hourmeter will be displayed during the startup messaging sequence and will be in hourmeter menu. NO = This hourmeter will not be displayed during the startup messaging sequence and will be shown with the “other meters and counters” lists.
DISPLAY TOTAL SWITCH ON HR	NO / **YES**	YES = This hourmeter will be displayed during the startup messaging sequence and will be in hourmeter menu. NO = This hourmeter will not be displayed during the startup messaging sequence and will be shown with the “other meters and counters” lists.
DIESEL RESET VALUE (Refer to Section 2.6 for oil change intervals)	**OFF** 50 TO 30,000 HRS	OFF = The Engine Maintenance hourmeter is turned off. 50 – 30,000 hrs = The value selected here will be the number of hours between engine service intervals.
SWITCH ON RESET VALUE	**OFF** 50 TO 30,000 HRS	OFF = The Switch-On Maintenance hourmeter is turned off. 50 – 30,000 hrs = The value selected here will be the number of hours between Switch-On service intervals.

CONFIGURATION	SELECTIONS	DESCRIPTION
•PM (1-5)	**OFF**	OFF = The PM 1-5 Maintenance hourmeter(s) is turned off.
	ENGINE HOURS	ENGINE HOURS = PM meter will count engine hours until the next service interval.
	SWITCH ON HOURS	SWITCH ON HOURS = PM meter will count Switch On Hours until the next service interval.
	CLUTCH CYCLES	CLUTCH CYCLES = PM meter will count how many times the fan clutch cycled on / off until the next service interval.
	START CYCLES	START CYCLES = PM meter will count how many times the engine has started until the next service interval.
	HIGH SPEED HOURS	HIGH SPEED HOURS = PM meter will count how many hours the unit operated in high speed until the next service interval.
•PM (1-5) RESET INTERVAL (This is not displayed unless the PM meter is assigned to a counter in the previous configuration.)	ENGINE HOURS	OFF = PM (1-5) is not being used.
	OFF or 50 TO 30,000 HRS in 50 hr increments	ENGINE HOURS = PM (1-5) is connected to the engine hourmeter. The reset interval will be (50 – 30,000 hrs).
	OFF or SWITCH ON HOURS 50 TO 30,000 HRS in 50 hr increments	SWITCH ON HOURS = PM (1-5) is connected to the switch on hourmeter. The reset interval will be (50 – 30,000 hrs).
	OFF or CLUTCH CYCLES 1,000 TO 90,000 CYCLES in 1,000 cycle increments	CLUTCH CYCLES = PM (1-5) is connected to the clutch cycle meter. This meter counts every time the fan clutch engages. The reset interval will be (1,000 to 90,000 cycles).
	OFF or START CYCLES 1,000 TO 90,000 CYCLES in 1,000 cycle increments	START CYCLES = PM (1-5) is connected to the clutch cycle meter. This meter counts every time the engine starter engages. The reset interval will be (1,000 to 90,000 cycles)
	OFF or HIGH SPEED HOURS 50 – 30000 HRS in 50 hr increments	HIGH SPEED HOURS = PM (1-5) is connected to the high engine speed hourmeter, which counts only high speed engine hours. The reset interval will be (50 – 30,000 hrs).
PRODUCTSHIELD SETUP **NOTE:** ProductShield is only available when IntelliSet is installed. Refer to Section 4.5.2 for more information on the following settings.		This message will only appear if ProductShield is installed. The information set in the following configurations can be read in the Unit Data list.
– PRODUCTSHIELD ECONO	**OFF**	OFF = ProductShield Econo is OFF
	GO TO START/STOP	GO TO START/STOP = Allows unit to be set for and operate in Continuous Run until ambient temperature falls **within** a user-defined range when unit will go to START/STOP. This allows fuel savings while offering Continuous Run operation protection when ambient is outside range. Unit will return to Continuous Run when ambient goes beyond range.
	GO TO CONTINUOUS	GO TO CONTINUOUS = Allows unit to be set for and operate in START/STOP until ambient temperature falls **outside** a user-defined range when unit will go to Continuous Run. This provides continuous air flow and good product protection for extreme ambient temperatures. Unit will return to START/-STOP when ambient comes back inside range.

CONFIGURATION	SELECTIONS	DESCRIPTION
PRODUCTSHIELD ECONO MIN TEMP	**OFF** or -20°F to +119.0°F (-28.9°C to +48.4°C) (in 0.5° increments) Default: **119.0°F (48.4°C)**	OFF = There is no lower limit for this parameter. Refer to Section 4.5.2 for more information on this setting. Select the lowest ambient temperature desired to activate ProductShield Econo. If ProductShield Econo is Go To Cont, this parameter's upper limit is ProductShield Econo Max Temp minus 10°F (5.5°C). If ProductShield Econo is Go To Cont, default is OFF – otherwise 119.0°F (48.4°C)
PRODUCTSHIELD ECONO MAX TEMP	**OFF** or -20°F to +119.0°F (-28.9°C to +48.4°C) (in 0.5° increments) Default: **119.0°F (48.4°C)**	OFF = There is no upper limit for this parameter. Select the highest ambient temperature desired to activate ProductShield Econo If ProductShield Econo Install is Go To Cont, this parameter's upper limit is ProductShield Econo Min Temp plus 10°F (5.5°C). If ProductShield Econo Install is Go To Cont, default is OFF – otherwise 119.0°F (48.4°C)
PRODUCTSHIELD ECONO – DELTA-T	**OFF** +3.6°F to +27.0°F (+2°C to 15°C) (in 0.5° increments	OFF = Delta-T is not used in determining when the unit will go into Econo: Go To Start/Stop mode. Select the desired delta-T value for activation of ProductShield Econo
PRODUCTSHIELD HIGH AIR	**OFF** ON	OFF = ProductShield High Air is OFF ON = ProductShield High air is ON
PRODUCTSHIELD HIGH AIR MIN TEMP	**OFF** or -20°F to +119.0°F (-28.9°C to +48.4°C) (in 0.5°F or °C increments) Default: **119.0°F (48.4°C)**	OFF = There is no lower limit for this parameter. Refer to Section 4.5.2 for more information on this setting. Select the lowest ambient temperature desired to activate ProductShield High Air
PRODUCTSHIELD HIGH AIR MAX TEMP	**OFF** or -20°F to +119.0°F (-28.9°C to +48.4°C) (in 0.5° increments) Default: **119.0°F (48.4°C)**	OFF = There is no lower limit for this parameter. Refer to Section 4.5.2 for more information on this setting. Select the highest ambient temperature desired to activate ProductShield High Air
PRODUCTSHIELD HIGH AIR DELTA-T	**OFF** +3.6° F to +27.0°F (+2°C to 15°C) (in 0.5° increments	OFF = Delta-T is not used in determining when the unit will go into Econo: Go To Start/Stop mode. Select the desired delta-T value for activation of ProductShield High Air
PRODUCTSHIELD WINTER - xx°	**OFF** -20°F to +32.0°F (-28.9°C to 0°C) (in 0.5° C or °F increments	Select the desired ambient temperature below which ProductShield Winter will operate (forced Continuous Run operation.)
•RANGE (1-2) LOCK	**OFF** START-STOP CONTINUOUS	OFF = If both Range 1 & Range 2 locks are off, Start-Stop or Continuous Run may be selected. If either Range 1 or Range 2 is not OFF, the unit will operate in the selected mode whenever the setpoint is within that range. START-STOP = The unit will always operate in Start-Stop whenever the setpoint is between the minimum & maximum temperatures for that range (see below). CONTINUOUS = The unit will always operate in Continuous Run whenever the setpoint is between the minimum & maximum temperatures for that range (see below).

CONFIGURATION	SELECTIONS	DESCRIPTION
•RANGE (1-2) MINIMUM TEMP	-22°F TO +**89.6**°F (-30°C to +**32**°C) (in 0.1° increments)	Select the lowest temperature desired for either Range 1 and/or Range 2.
•RANGE (1-2) MAXIMUM TEMP	⟨-22°F TO +**89.6**°F (-30°C to +**32**°**C**) (in 0.1° increments)	Select the highest temperature desired for either Range 1 and/or Range 2.
MIN SETPOINT	**-22°F** TO +89.6°F (-30°C to +32°C) (in 0.1° increments)	Select the lowest temperature that will ever be used as setpoint. Setpoint can not be set lower than this value.
MAX SETPOINT	-22°F TO +**89.6**°F (-30°C to +**32**°**C**) (in 0.1° increments)	Select the highest temperature that will ever be used as setpoint. Setpoint can not be set higher than this value.
AUTO FRESH AIR EXCHANGE	**NOT INSTALLED** / STANDARD	Indicates if the Auto Fresh Air Exchange is installed. If AutoFresh Air hardware is not installed, this configuration needs to be set to NOT INSTALLED to prevent alarms from occurring.
AUTO FRESH AIR DELAY	**SETPOINT** 0-48 HOURS IN 1 HOUR INCREMENTS	SETPOINT – Once the compartment temperature has reached setpoint ±1.5°F (0.8°C), the Auto-Fresh Air Exchange system will start to operate based on the parameters selected in the Functional Parameter list. 0 to 48 Hours – After this length of time, AutoFresh Air Exchange will begin if the unit is no longer running in pull down mode (See Section 4.4.2), even though the compartment temperature has never reached setpoint.
S/S PARAMETERS	**TOGETHER** SEPARATE	TOGETHER = When the Minimum Run Time, Minimum Off Time, Maximum Off Time, and Override Temperatures are set in the Functional Parameter List, the same values will be used for both Frozen and Perishable setpoints. SEPARATE = When the Minimum Run Time, Minimum Off Time, Maximum Off Time, and Override Temperatures are set in the Functional Parameter List, different values may be entered for Perishable and Frozen setpoints.
REMOTE TEMP SENSOR (1-3) (Optional) **NOTE:** Sensor(s) on DataRecorder must also be set.	ON / **OFF**	ON=A remote sensor has been added to the unit and connected into the wire harness at Remote Temp Sensor (1-3) plug. This enables Remote Temp Sensor (1-3) to be read through the Data List. OFF=There is no Remote Sensor (1-3) in this unit.
DOOR SWITCH: (Optional) **NOTE:** Sensor(s) on DataRecorder must also be set.	**SWITCH NOT INSTALLED** OPEN SWITCH OPEN OPEN SWITCH CLOSED	SWITCH NOT INSTALLED = There is no door switch in this compartment. DOOR OPEN SWITCH OPEN = A door switch has been installed on one of the refrigerated compartment doors. The switch contacts will be OPEN whenever the door is OPEN. DOOR OPEN SWITCH CLOSED = A door switch has been installed on one of the refrigerated compartment doors. The switch contacts will be CLOSED whenever the door is OPEN.

CONFIGURATION	SELECTIONS	DESCRIPTION
DOOR SWITCH: (Optional)	**ALARM ONLY**	ALARM ONLY = When Door switch indicates that the door is open, a warning alarm will be displayed in the MessageCenter.
	UNIT SHUTDOWN	UNIT SHUTDOWN = When Door switch indicates that the door is open, a warning alarm will be displayed in the MessageCenter and the unit will shutdown.
	LOW ENGINE SPEED	LOW ENGINE SPEED = When Door switch indicates that the door is open, the engine will be forced to low speed.
	DATA RECORDER ONLY	DATA RECORDER ONLY = The data recorder will record every time the door is opened or closed. There will be no alarms or messages displayed in the MessageCenter.
REMOTE SWITCH(1-2) (Optional) **NOTE:** Sensor(s) on DataRecorder must also be set.	**NOT INSTALLED**	NOT INSTALLED = This remote switch is not installed in this unit.
	DOOR OPEN SWITCH OPEN	DOOR OPEN SWITCH OPEN = The Remote switch will be used as a refrigerated compartment door switch. The switch contacts will be OPEN whenever the door is OPEN.
	DOOR OPEN SWITCH CLOSED	DOOR OPEN SWITCH CLOSED = The Remote switch will be used as a refrigerated compartment door switch. The switch contacts will be CLOSED whenever the door is OPEN.
	SWITCH ON CONTACTS OPEN	SWITCH ON CONTACTS OPEN = The Remote switch will be used as a remote control switch. The switch contacts will be OPEN whenever the switch is in the ON position.
	SWITCH ON CONTACTS CLOSE(D)	SWITCH ON CONTACTS CLOSE(D) = The Remote switch will be used as a remote control switch. The switch contacts will be CLOSED whenever the switch is in the ON position.
REMOTE SWITCH (1-2) (Optional)	**ALARM ONLY**	ALARM ONLY = When Door switch indicates that the door is open, a warning alarm will be displayed in the MessageCenter.
	UNIT SHUTDOWN	UNIT SHUTDOWN = When Door switch indicates that the door is open, a warning alarm will be displayed in the MessageCenter and the unit will shutdown.
	LOW ENGINE SPEED	LOW ENGINE SPEED = When Door switch indicates that the door is open, the engine will be forced to low speed.
	DATA RECORDER ONLY	DATA RECORDER ONLY = The data recorder will record every time the door is opened or closed. There will be no alarms or messages displayed in the MessageCenter.
SET TIME		The following will allow the Real Time Clock in the DataRecorder to be set. The time set here can be read in the unit data list.
• MONTH	1-12	Select the correct month of the year.
• DAY	1-31	Select the correct day of the month.
• YEAR	1998 - 2037	Select the correct year.
• HOURS	0-23	Select the correct hour (0-11 is AM / 12-23 is PM)
• MINUTES	0-59	Select the correct minute.

CONFIGURATION	SELECTIONS	DESCRIPTION
LIGHT BAR	**8** / 2	Indicates the type of light bar installed.
8 HR ADDITIONAL DATA:	**YES** / NO	YES = When the START/RUN-OFF switch is turned OFF, the data recorder will continue to record sensor data for an additional 8 hours. NO = When the START/RUN-OFF switch is turned OFF, the data recorder will stop recording all data.
DECIMAL	**DISPLAYED** NOT DISPLAYED	DISPLAYED = setpoint will be shown with a decimal and temperatures may be selected to a tenth of a degree. NOT DISPLAYED = setpoint will not be shown with a decimal. All other temperatures will still be displayed with a decimal.
HIGH SPEED DELAY	**1 MIN** 0 TO 10 MINUTES IN 0.5 MINUTE INCREMENTS	Select the length of time unit remains in low speed before transitioning to high speed.
SATELLITE COMM (Optional) (This configuration is only visible in the microprocessor configuration list when the DataTrak option is installed in the microprocessor. It is always visible in the configuration list in ReeferManager, although it is non-functional until the DataTrak option is installed.)	QUALCOMM **OTHER**	QUALCOMM = The microprocessor is set to send Qualcomm communication messages. OTHER = The microprocessor is set to send communication messages to communication telematics companies other than Qualcomm.
UNIT OPERATION:	**STANDARD** RAIL	STANDARD = The microprocessor is set to control trailer refrigeration operation. RAIL = The microprocessor is set to control rail refrigeration operation.
VEHICLE ID: This is only available when Unit Operation: “Rail” is selected in above configuration.	ASSET **TRAILER** CAR	If Rail is selected for Unit Operation, this indicates type of vehicle in use. This selection will be used as the label text when displaying Trailer/Asset/Car ID for modification.
RAIL SHUTDOWN OVERRIDE:	NO **YES**	NO = When Alarm 30 or Alarm 31 occur, the unit will not automatically restart until the Alarms are cleared. YES = When Alarm 30 or Alarm 31 occur, the unit will automatically restart after 3 hours.
RAIL OVERRIDE RESTART: This is only available when Unit Operation: “Rail” is selected in above configuration.	1-20 **3**	If Rail is selected for Unit Operation and the Rail Shutdown Override is in effect this indicates the number of restarts allowed.
ENABLE INTELLISET AT = KEY	**NO** YES	NO = Pressing the SELECT key will allow the user to access the IntelliSet Menu. YES = Pressing the = key will allow the user to access the IntelliSet Menu.
CONFIGS COMPLETE = TO EXIT		Press = to return to the Configuration Main Menu

5.2.2 Component Test Mode

NOTE

To enter Component Test mode refer to Section 5.2.

Component Test mode allows the Technician to energize individual circuits for five minutes at a time while the unit isn't running. The engine is not allowed to start when the Micro is in Component Test mode.

From the Main Menu, select Component Test mode and press =. Use the UP or Down arrow keys to scroll through the list when "↑ ↓ TO SCROLL, THEN = TO SELECT" appears in the MessageCenter. Press = to select the component you wish to test. For example, if the Cool Light is selected, the Cool Light on the Light Bar will come on, and "COOL LIGHT OFF IN 5 MINUTES" will appear in the MessageCenter. The minutes will count down to 0 at which time the Cool Light circuit will be de-energized and the MessageCenter will display the last component tested.

The test may be stopped at any time by turning the START/RUN-OFF switch to the Off position or by pressing and holding the = key for six seconds. Should you need more than five minutes, the timer may be reset to five minutes anytime during the test by pressing the = key. The timer may only be reset once during each test. After the 5-minute timer expires, the MessageCenter will return to the Component Test mode Menu and display the last component tested.

To retest the same component and circuit again, press =. To select another component to test, press the UP or DOWN Arrow keys to select another component, and press = to select. To go to Service mode or Configuration mode, select Main Menu and press =.

The only keys that operate during Component Test mode are the ALARM and SELECT keys. The alarm list is available for you to look at any active or inactive alarms. The SELECT key will only allow access to the Amp Current Draw for the item in the Data List.

When Component Test mode is selected, the Main Display will show OFF.

The following components may be tested during the Component Test mode:

Component / Menu List	MessageCenter	FET LED	Board LED
Cool Light *	COOL LIGHT OFF IN X MINS	17	
Heat Light *	HEAT LIGHT OFF IN X MINS	8	
Defrost Light *	DEFROST LIGHT OFF IN X MINS	16	
Auto Restart Light *	ARL LIGHT OFF IN X MINS	7	
Out Of Range Light *	ORL LIGHT OFF IN X MINS	15	
Fault Light *	FAULT LIGHT OFF IN X MINS.	14	
Unloader 1 (front)	UL1 OFF IN X MINS	23	
Unloader 2 (rear)	UL2 OFF IN X MINS	22	
SV1	SV1 OFF IN X MINS	10	
SV2	SV2 OFF IN X MINS	21	
SV4	SV4 OFF IN X MINS	9	
Clutch Relay	CLHR OFF IN X MINS		29
Speed Relay	SR OFF IN X MINS		27
Run Relay	RR OFF IN X MINS		28
Buzzer	BUZZER OFF IN X MINS	18	
Glow Plug Relay	GPR OFF IN X MINS		30
AutoFresh Air Exchange Relay	AFAR OFF IN X MINS	12	
Main Menu (To access Component Test mode or Configuration mode)			
* These are for the Light Bar only. The FET LED will illuminate, however the corresponding indicator LED on the Display will not illuminate.			

NOTE

Electronic speed control modules can not be tested through the microprocessor. Refer to Section 9.4.1 for Troubleshooting guide for units with Electronic Speed Control Engines.

5.2.3 Service Mode

⚠ CAUTION

Service mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating.

NOTE

Unit START/RUN-OFF switch MUST be in START/RUN position to keep unit in Service mode. If the switch is turned OFF, the unit exits Service mode and closes CSMV to 0% open and de-energizes UL1.

⚠ WARNING

UNITS EQUIPPED WITH STAR-TRAK TWO WAY COMMUNICATION CAPABILITIES MAY HAVE THE ABILITY TO BE STARTED OR TURNED OFF REMOTELY REGARDLESS OF THE SETTING OF THE START/RUN-OFF SWITCH.

The unit is controlled locally and there can be no two-way communication when the mode switch on the Remote Monitoring Control Box is in MAINTENANCE mode. Therefore, when performing any work on the unit, place the mode switch in MAINTENANCE MODE. After the unit is serviced, return the mode switch to REMOTE ON. (Refer to Section 3.19.3 for more information on two-way communication.)

a. Scroll through the Main Menu then press the = key when SERVICE MODE appears in the MessageCenter.

b. ENTERING SERVICE MODE will appear in the MessageCenter, and OFF will be displayed instead of the setpoint and compartment temperature.

c. Once the CSMV is 100% open, "RECOVER / LEAK CHK / EVAC MODE" is displayed in the MessageCenter.

d. Refrigerant recovery, leak checking, or evacuation may be performed on the unit at this time. Refer to Service Procedures in Section 8.

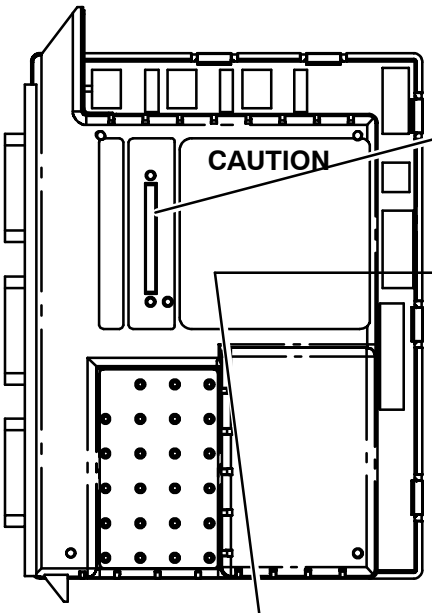
e. When the refrigeration system is evacuated the system pressure will go into a deep vacuum. Once this occurs, the MessageCenter will change to "EVAC/CHARGE MODE." The position of the CSMV and UL1 does not change in this mode.

f. Following the evacuation, as refrigerant pressure is introduced into the system, once both the suction and discharge pressure both rise above 5 PSIG (0.34 Bar) the microprocessor will close the CSMV to 0% and de-energize UL1. When the CSMV is closed "CHARGE MODE – HOLD = TO EXIT" is displayed in the MessageCenter. The = key must be pressed and held for six seconds to exit Service mode or the START/RUN-OFF switch can be be turned Off then On.

g. If the unit shifts to Charge mode and "CHARGE MODE – HOLD = TO EXIT" is displayed in the MessageCenter while you are still recovering refrigerant, leak testing or evacuating the refrigeration system, DO NOT CONTINUE. Exit Service mode and then reenter, making sure that "RECOVER / LEAK CHK / EVAC MODE" is displayed in the MessageCenter before performing any of these services.

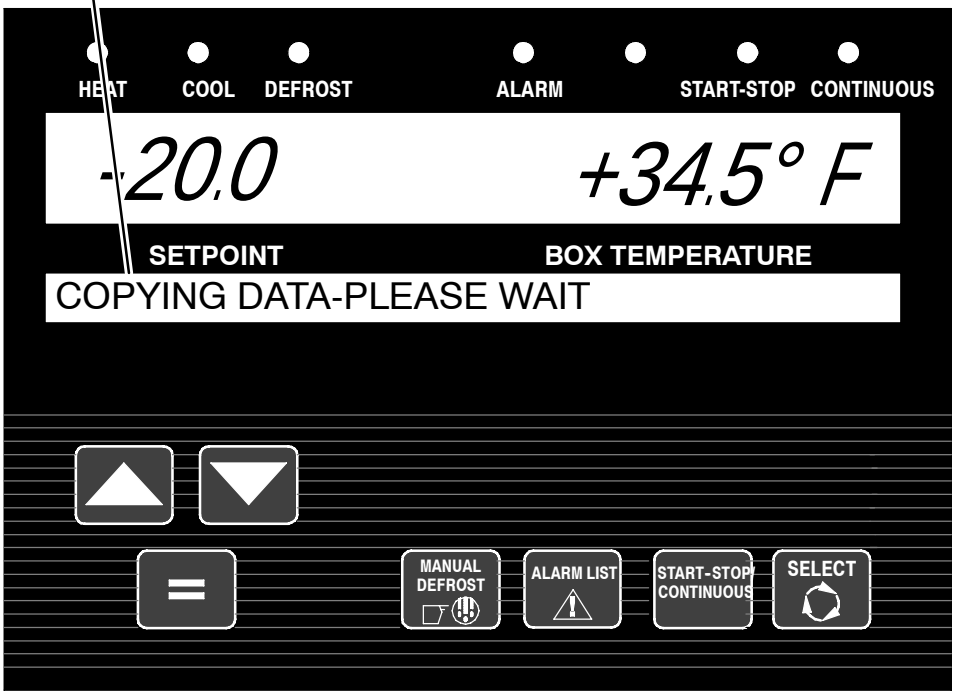
h. To exit Service mode at any time, press and hold the = key for three seconds. "EXITING SERVICE mode" will then appear in the MessageCenter. When exiting Service mode the microprocessor closes the CSMV to 0% and de-energizes UL1.

5.3 DOWNLOADING DATA WITH THE PC CARD



1. Place the Micro in PC mode (Refer to Section 5.1), or place the START/RUN-OFF switch in the START/RUN position.
2. Insert a Download PC card into the PC card slot on the front of the microprocessor. Be certain that the instruction label is facing the “Caution” label. Do not force card into slot. Hold the Download PC card at the end opposite the plug end. Do not squeeze the card in the middle while inserting.
3. The MessageCenter will show “COPYING DATA-PLEASE WAIT.” While the data is being copied, the green PC CARD STATUS LED will flash on for one second then off for one second in tandem with the Micro Status LED.
4. When the copy is complete, “COPY COMPLETE, REMOVE CARD X” (“X” is the number of empty spaces remaining on the card) will show in the MessageCenter. The PC card Status LED will stop blinking but be on solid. You may then remove the PC card. ***Do not remove the card until prompted to do so.***
5. When the card is removed, the MessageCenter will return to the default message.
6. If any other messages appear, refer to Section 6.1 MessageCenter for an explanation of the error message. If there is an error, the PC CARD FAULT LED will be on until the card is removed.

NOTE: Data must be downloaded off of the Download PC card onto a computer drive before it can be viewed.



5.4 INSTALLING NEW SOFTWARE

NOTE

All units should have the Controller software upgraded to 04.05.00 (04.07.00 for X2 units) or above. It is no longer possible to load any versions of 03 software into that microprocessor. Newer versions can be loaded as they are released.

5.4.1 Software Version Numbers

The first two digits of the software revision number (e.g. “04”) indicates the major release. Major releases occur when significant changes are made to the software. Whenever a major change to software is made and that software is installed into a microprocessor, it is not possible to downgrade the software back to any lower major release version.

The second two digits (e.g. “05”) indicate a minor release. Minor releases occur when new features, new models or other enhancements are added to the software. Software versions of newer or older minor versions can be installed into a microprocessor as needed.

The third set of digits (e.g. “00”) is the actual release number. Production software is generally “00”. Test and experimental versions will have a different number. The third digit does not affect the major or minor designation; therefore, the software can still be installed into a microprocessor as needed.

NOTE

Some test or experimental versions may be the ONLY current version that will operate correctly in a particular unit. Until a new production version is announced, changing the software may result in incorrect unit operation.

5.4.2 Using The Program PC Card

TIP

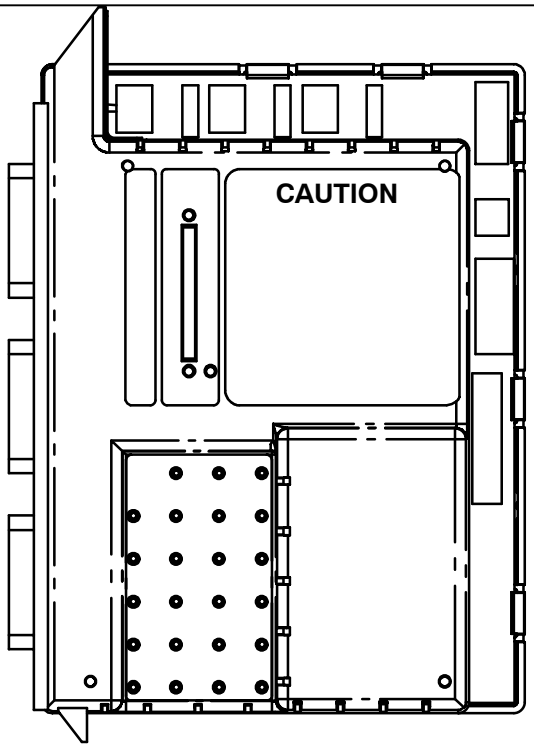
Whenever performing a major operation to a microprocessor, such as installing new operating software, it is always a good idea to start the unit and give it a quick check over *prior* to performing the operation.

NOTE

Once the unit shuts down to begin the software install process, the Suction Modulation Valve closing process begins. The software installation processes will not begin until the CSMV is completely closed, which will delay the actual process for about 45 seconds.

⚠ CAUTION

The display and MessageCenter may behave differently during the software loading process, depending on the version of software currently in the controller. DO NOT INTERRUPT THE SOFTWARE INSTALLATION PROCESS ONCE IT HAS STARTED.



1. Place the Micro in PC mode (Refer to Section 5.1), or place the START/RUN-OFF switch in the START/RUN position.
2. Insert a Program PC card into the PC card slot on the front of the microprocessor. Be certain that the instruction label on Program PC card is facing the “Caution” label on the microprocessor. **Do not force card into slot. Hold the Program PC card at the end opposite the plug end. Do not squeeze the card in the middle while inserting. (See Section 2.5.4 for PC card care)**
3. The MessageCenter will show one of three different messages:
   Same SW: “= to Load, ↑ To Cancel”
   Old SW: “= to Load, ↑ To Cancel”
   New SW: “= to Load, ↑ To Cancel”
4. Verify by the message that you are upgrading/downgrading the software according to your intentions.
5. Press = to load the program. The MessageCenter will show “ENGINE AND MICRO WILL STOP NOW.” If the engine is running, it will shut down. After about 45 seconds the MessageCenter backlight will dim and the message “INSTALLING PROGRAM SOFTWARE” will be displayed. The Card Status LED adjacent to the PC card slot will blink together with the Micro Status LED at a rate of 1/2 second on then 1/2 second of during this installation process. Once the entire program has been loaded, the MessageCenter will show “INSTALL COMPLETE – REMOVE CARD. At the same time, the Card Status LED will stop blinking and be on solid, indicating that the software install is complete.
6. When the card is removed, the Micro will power up as it was prior to inserting the card (PC mode or unit running). Allow the Micro to completely power up (Main Display and MessageCenter displaying appropriate messages) once after installing the new software before turning the power off, or removing the PC mode jumper. **DO NOT TURN THE START/RUN-OFF SWITCH OFF DURING THE INITIAL START FOLLOWING A SOFTWARE UPGRADE**.

5.4.3 Using MicroProgrammer

⚠ CAUTION

It is important that communications between the Micro and the computer are not disturbed during the software loading process. If using a laptop computer, turn all energy saving features off. Turn off any screen saver or any hard drive time out settings.

NOTE

04.05.00 (04.06.00 for X2 units) software and above can be installed using either the preferred previously described Program PC card method or by using MicroProgrammer 3.14 and a computer. Existing Program PC cards may be upgraded to 04.05.00 or 04.06.00 by using the ReeferManager program.

NOTE

Only MicroProgrammer version 3.14 is to be used to properly install the 04.05.00 or 04.06.00 software. Earlier versions of MicroProgrammer should be discarded. MicroProgrammer ONLY RUNS ON Windows 95/98. ***It will NOT RUN on Windows 2000 or XP.***

Computer Preparation: It is important to set up the PC that will be used with MicroProgrammer:

- The screen saver must be turned off.
- The battery should be capable of running the PC for 30 minutes, or the PC should be plugged into an electrical outlet.
- All battery saver features (hard drive time out, monitor time out, etc.) should be set to more than 30 minutes.
- The download cable must be connected to a 9-pin COM port on the PC. USB to COM Port adaptors will not work.

a. Connect the computer to the microprocessor using a Download Cable. Once the cable is connected to the download port, the microprocessor will power up and show “PC MODE.”

b. Start the program by double clicking on the Microprogrammer icon on your computer desktop.

c. Click on the Load File button. The Open box will appear on the screen.

d. Using the mouse, select the file you want to load (this will be a .bex file) by clicking once on it to highlight it.

e. Click the OK button. Watch the lower left message area of the program. Once the file is validated, the Program Micro button will become active.

f. Turn the START/RUN-OFF switch to the START/-RUN position. Wait for the Main Display and MessageCenter to power up.

g. Click on the Program Micro button. The MessageCenter will go show “ENGINE AND MICRO WILL STOP NOW” for a few seconds. If the engine was running, it will shut down. Nothing will happen for the first 5-10 seconds, then the software will begin to load. The MessageCenter backlight will go dim and “INSTALLING PROGRAM SOFTWARE” will be displayed Micro Status LED will start blinking at the rate of 0.5 seconds on / 0.5 seconds off.

h. The % complete value on the computer screen will increment itself as the program is loaded. The % complete will stop one or two times during the loading process for up to 15 seconds. This is normal. DO NOT STOP THE PROCESS. The time to load the program is dependent upon the speed of the computer. This will generally take from four to six minutes.

i. It is important that the program is not interrupted from the time the “Program Micro” button is clicked until the program is completely loaded. Once the % complete reaches 100%. The MessageCenter will show “INSTALL COMPLETE” and the shutdown box will appear. Click the OK button.

j. The microprocessor will power up and the unit will start. Allow the engine to start completely the first time after loading software. **DO NOT TURN THE START/RUN--OFF SWITCH OFF DURING THE INITIAL START FOLLOWING A SOFTWARE UPGRADE**.

5.4.4 Troubleshooting Software Loading Problems

If after loading the software program, the microprocessor does not power up, or the engine does not start, use the following to isolate the problem.

a. Did the unit perform properly prior to loading the software? If not, the problem most likely is not a result of the software loading process.

b. Check the Micro Status LED near the PC card slot on the microprocessor. It should be blinking continuously at the rate of one second on and one second off. This is the “normal” heartbeat rate of the microprocessor.

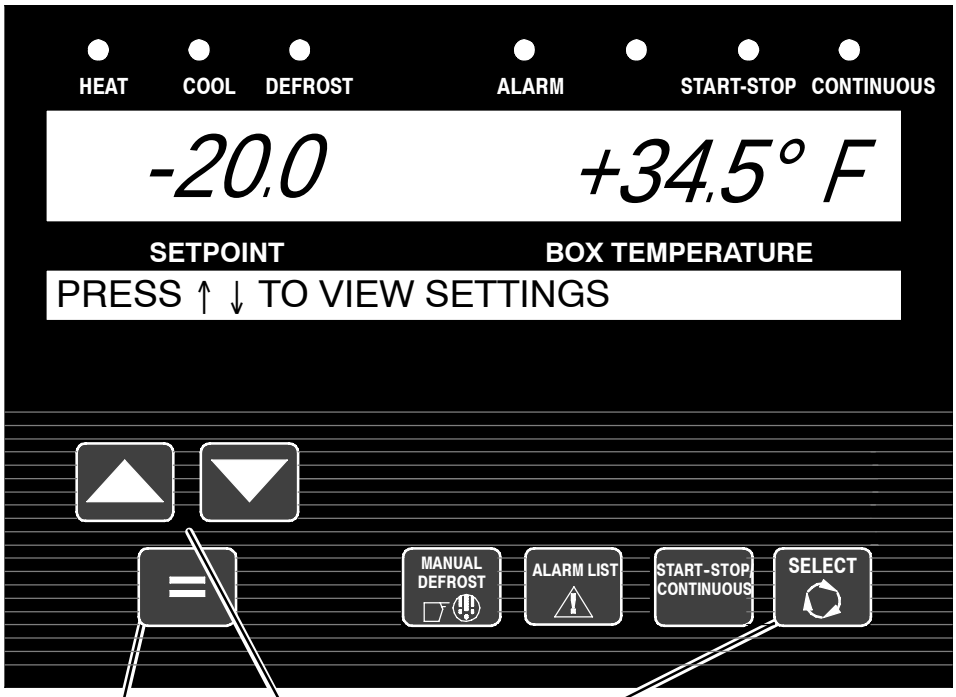
c. If the Micro Status LED is blinking at the rate of .5 seconds on and .5 seconds off, the microprocessor is still in Program mode, and the software is not fully loaded into memory. Load the software again, being careful to follow each step completely in sequence.

d. If the Micro Status LED is not on at all, check voltage to QC1 (+) & QC2 (-). Also check for voltage from the START/RUN-OFF switch between QC2 (-) and 5MPA1 (+). Voltage readings should be 12.0 to 13.0 vdc. If voltage and grounds check OK, the microprocessor may be dead and require replacement.

5.5 RE-SETTING PM (PREVENTATIVE MAINTENANCE) HOURMETERS

TIP

PM hourmeters may be reset for the next maintenance interval from the Functional Parameter list using the keypad.



1. Press the SELECT key until "PRESS ↑↓ TO VIEW SETTINGS." appears in the MessageCenter.
2. Press the UP ARROW key or the DOWN ARROW key until RESET PM HOURMETERS is displayed.
3. Press = key. "↑ ↓ TO SCROLL, THEN = TO SELECT" will show in the MessageCenter.
4. If "NO HOURMETERS TO RESET" appears there are none to reset.
5. Press UP or DOWN ARROW key until the PM hourmeter you wish to reset is shown.
6. The MessageCenter will show the hourmeter name with the instructions "= TO RESET," followed by the number of hours or cycles that will be used for the next service interval.
7. Press = key to reset the hourmeter to the new value shown.
8. The name of the hourmeter and "RESET" will be displayed indicating that the reset was successful.
9. Repeat steps 5-7 to Reset additional PM hourmeters

NOTE

First the hourmeters must be configured "ON" (Refer to Section 5.2.1)

PM (Preventative Maintenance) hourmeters are provided to track unit operation and to notify the user when periodic preventative maintenance is due. Within the Advance Microprocessor, there are seven PM hourmeters available for use:

- Engine
- Switch On
- Five programmable hourmeters

SETTING PM (PREVENTATIVE MAINTENANCE) HOURMETERS (Continued)

The programmable PM hourmeters (PM1 – PM5) that can be configured to count any of the following:

- Engine Hours
- Switch On Hours
- Clutch Cycles
- Start Cycles
- High Speed Hours

The PM hourmeters are activated and the reset interval is selected from the Configuration List. To turn on the Engine PM hourmeter, select the desired maintenance interval (in hours), and enter as the "DIESEL RESET VALUE" in the Configuration list. Selecting OFF will completely turn the Engine PM hourmeter off. The reset value selected here will be the value used when the PM hourmeter is reset from the Functional Parameter List.

To turn on the switch on PM hourmeter, select the desired maintenance interval (in hours), and enter as the "SWITCH ON RESET VALUE" in the Configuration list. Selecting OFF will completely turn the switch on PM hourmeter off.

To turn on any of the Programmable PM hourmeters, they must first be programmed to count one of the available parameters from the list above. For example, PM 1 may be programmed to count Clutch Cycles. Selecting OFF will completely disable the PM hourmeter. Once a selection is made, then a reset interval may be selected. For hours, the PM hourmeter may be set in 50 hour increments anywhere from 50 to 30,000 hours. For cycles, the PM hourmeter may be set in 1,000 cycle increments anywhere from 1,000 to 90,000 cycles. Selecting OFF instead of an interval will also disable the PM hourmeter.

Once the PM hourmeters are activated from the Configuration List, they can only be RESET for a new interval from the Functional Parameter List.

The PM hourmeters may be set or reset using either a PC or the keypad. Reset is accessible from the Functional Parameter list.

RESET is only available when the accumulated hours or cycles are more than 95% of the reset value for that hourmeter. (For example: the Engine PM hourmeter reset interval is 1000 hrs. Reset will be allowed anytime after 950 hours have expired.)

TIP

Factory default is OFF for all PM hourmeters.

To reset a PM hourmeter that has not expired and is not found in the functional parameter list:

a. From the Configuration list, select the PM hourmeter.
b. Press = to change.
c. Select Off for the interval.
d. Press = to enter.
e. Press = to change.
f. Select the correct interval.
g. Press = to enter.
h. Turn the START/RUN-OFF switch off then back to START/RUN. Check the Data list. The correct number of hours should be showing as "HOURS TO ENGINE MAINT."

5.6 ADVANCE MICROPROCESSOR REPLACEMENT & CONFIGURATION SETUP

When field diagnosis of a Carrier Transicold Trailer or Rail refrigeration unit determines that an Advance Microprocessor is not performing properly and must be replaced, the following steps MUST be taken to ensure correct operation of the unit following the repair.

Prior to beginning work on the unit, be certain that the current configuration file has been downloaded for the customer from the Carrier Transicold Information Center, and written onto a Configuration PC card using the ReeferManager Program. If the original microprocessor was equipped with the IntelliSet option, this file will need to be on a Configuration PC card in order to install the IntelliSet parameters into the replacement microprocessor.

NOTE

A single set of configurations, functional parameters and data recorder settings can be sent serially to the microprocessor using the ReeferManager program. Multiple sets of settings (IntelliSets) can only be sent to the microprocessor by using a Configuration PC card.

5.6.1 Microprocessor Replacement

a. If possible, power the microprocessor up, either using a PC mode jumper, or by turning the START/RUN--OFF switch to the Run position. If the microprocessor will not power up, skip ahead to step d.

b. Insert a Download PC card into the PC card slot and download all data from the data recorder. If a Download PC card is not available, data may also be downloaded using a download cable and the ReeferManager PC Program.

c. Then, scroll through the Data List and make note of the following from the MessageCenter:
   - ID Number
   - Unit Serial Number
   - Unit Model Number
   - Engine Protect Hours
   - Switch On Protect Hours
   - Engine Sleep Hours
   - Switch On Sleep Hours
   - High Speed Hours
   - Clutch Hours
   - Start Cycles
   - Date and Time

d. Remove PC jumper or turn START/RUN-OFF switch to Off.

e. Remove negative battery cable from battery.

f. Remove Connectors 1MP, 2MP, & 3MP from the outside of the control box.

g. Open keypad door by removing the screws at the bottom. Open control box door and use the retaining rod to hold the door open.

h. Remove Connectors 5MP & 6MP inside the control box. Remove all wires from the Micro.

i. Locate wire to 80A fuse that runs through the Current Sensor. Note the orientation of the wire through the Current Sensor, to be certain that the wire is reinstalled through the new Current Sensor in the same direction. (Inserting the wire through the Current Sensor in the opposite direction will result in erroneous current readings.) Remove wire from fuse holder and gently pull through the Current Sensor.

j. Remove the screws holding the sides of the Micro into the control box. Remove the single screw holding the top of the Micro in place.

k. Pull the Micro back, and twist out of the control box.

l. Install the new Micro by reversing steps a. thru k.

5.6.2 Microprocessor Setup

NOTE

Before starting the unit, the microprocessor must be configured for the correct unit model family and model number. This can be done at the unit keypad, or by using the ReeferManager program. The steps below are used when setting the microprocessor up from the keypad.

Generally, the microprocessor can be setup using a Configuration PC card however certain parameters can not be set using a Configuration PC card. Those parameters can be entered using the keypad or the ReeferManager program. The steps below detail entering the data using the keypad.

a. Ensure that the new microprocessor is in place, all wires connected and the negative battery cable is reconnected.

b. Place the START/RUN-OFF switch in the START/-RUN position. The controller will immediately go into the Configuration List so that the correct model number can be selected. Using the Up or Down Arrow keys, scroll through the list until the correct Model Family appears, and press the = key. Use the Up or Down Arrow keys to scroll through the list of model numbers until the correct model number appears (verify the model / serial plate on the unit). Press the = key to enter the new model number.

c. Press the Up Arrow key again, and the unit serial number field will appear. Press the = key, then the Up Arrow key. You will see a blinking cursor in the field. Now, using the Up or Down Arrow keys, scroll through the Number / Letter list, until the first letter of the serial number you recorded above appears. Press the = key to enter that letter, and advance the cursor to the next place. Repeat this process until the entire unit serial number is entered
(i.e. LAD90887654).

d. Press the Up Arrow key again, and the ID field will appear. Press the = key, then the Up Arrow key. You will see a blinking cursor in the field. Using the Up or Down Arrow keys, scroll through the Number / Letter list, until the first letter / number of the ID you recorded above appears. Press the = key to enter that number / letter, and advance the cursor to the next place. Repeat this process until the entire ID number is entered. If the cursor is still blinking in a blank space after you are finished, slowly (wait two to three seconds between presses) press the = key to leave blanks in the remaining spaces. When you reach the end, the message
"↑↓ TO SCROLL, THEN = TO SELECT" will appear
(i.e. XYZ5678).

e. Press the Up Arrow key again, and SET NEW HOURS appears. Press the = key then the Up Arrow key to enter that menu.

f. The first hourmeter is Engine Protect Hours. Press the = key to select this meter. The cursor will be blinking on the ten-thousands place. Press the Up or Down Arrow key to select the correct value, then press the = key. If the correct number in any of the locations is 0 (zero), just press the = key to enter 0 as the value and move the cursor to the next place. For example, if you are entering 567 hours, you will press the = key twice to leave a 0 for the first two numbers, then use the Up and Down Arrow keys to scroll through the numbers to enter the correct hours. When the correct hours for Engine Protect Hours has been entered, press the = key to advance to the next hourmeter. If an invalid number is entered, a warning message will flash in the MessageCenter. For example, you can not enter a higher number of hours for Engine Protect than the number of Switch On Hours.

NOTE

None of the "Total" hourmeters are listed. When the hours for all the hourmeters are entered, the micro will add the correct hours together and calculate the Total Engine Hours, and Total Switch On Hours. When the end of the list is reached PRESS = TO SAVE HOURS will be displayed. Pressing the = key will save the hours, and return you to the configuration list.

If you do not press the = key, none of the time hours or cycles you just entered will be saved.

Hourmeters may be changed for 60 minutes following the initial hour entry. If an error has been made, be certain to correct it within the 60 minute time period. Following that time, the hourmeters will count the appropriate hours because the unit switch is on and the unit is operating, and no further manual changes will be allowed.

g. Now, press the Down Arrow key until SET TIME appears. Press the = key then the Up Arrow key to enter that menu.

⚠ CAUTION

Be certain that the clock you are using is accurate, and is showing the correct time. Also, some customers are located in different time zones from where the repair is being made. If you know what time zone they use, enter that time. If you don't, then enter the current time where you are located.

h. When MONTH appears, press the = key, then the Up Arrow key. The MessageCenter will begin to flash, indicating that it is ready to accept changes. Use the Up or Down Arrow keys to scroll through the number list until the correct number of the current month appears. Press the = key to enter that number for the month.

i. Now, press the Up Arrow key to go to day.

j. Using the same key presses as in h. and i. above, continue to enter the correct numerical value for the Day, Year, Hour and Minute. Hours are displayed and entered as a 24 hour clock. 0 to 12 is AM. 13 to 24 is PM.

k. When you are finished, the MessageCenter will show PRESS = TO SAVE TIME CHANGES.

NOTE

If you do not press the = key, none of the time changes you just made will be saved.

NOTE

If a Configuration card will be used to configure the microprocessor, skip ahead to CONFIGURATION CARD, Section **5.6.7** If the Configurations and Functional Parameters will be set from the keypad, continue with following steps 5.6.3 and 5.6.4

5.6.3 Configurations Via Keypad

Refer to Section 5.2 for list of available microprocessor configurations.

NOTE

Units equipped with IntelliSet MUST have the settings installed using ReeferManager and a Configuration PC card. IntelliSet settings CANNOT be installed by using either the keypad, or by using a laptop computer.

IntelliSet settings CANNOT be installed by using either the keypad or by using a laptop computer.

5.6.4 Functional Parameters via Keypad

Refer to Section 3.15 for the list of available Microprocessor Functional Parameters and for directions on how to access them. 5.6.5 Data /Recorder Via ReeferManager PC Program

NOTE

If the factory settings are used, you can skip this section and proceed to hourmeter Setup.

a. Refer to Section 3.18 for list of DataRecorder Setups.

b. Power up the microprocessor. If it is not already powered up, refer to directions under Microprocessor Setup – Functional Parameters via keypad, Section 5.6.4 above.

c. Connect your computer to the download port of the unit (use cable 22-001737) and start the ReeferManager program. You will need ReeferManager version 03.02.00 or higher.

NOTE

ReeferManager 03.02.00 is **REQUIRED** in order to view, change and send new features to and from the microprocessor.

d. In ReeferManager, go to the Serial Operations Tab, and then click on DataRecorder/Microprocessor setup button.

e. Select the Sensors to be recorded and whether you wish averaged or snapshot recordings (averaged is recommended for all temperature sensors; snapshot is recommended for pressure, voltage, amperage, & RPM).

f. When the setup is correct, press the Send button to send the new settings to the microprocessor.

g. From the "Confirm Send Information" Pop Up, check the data you want to send and un-check the data you don't want to send. Click the OK button.

h. Verify that the settings were sent, by waiting for the confirmation pop up message.

NOTE

If the DataRecorder date and time were not set earlier, they can be set from this screen by clicking on DataRecorder Tools>Set Time.

i. Leave the microprocessor powered up as you continue with the next section.

5.6.6 Engine And Switch-on Hourmeters Via ReeferManager PC Program

a. Start the ReeferManager program. Go to the Serial Operations Tab.

b. Click on DataRecorder/Microprocessor Setup button.

c. In the upper left menu bar, click on MicroprocessorTools>Set New Micro Hours.

d. At this screen, enter the hours that were recorded in step b. of Section 5.6.1. Send the new readings to the microprocessor.

NOTE

Hours can only be entered into the microprocessor until either the Total Engine Hours or the Total Switch On Hours reach 25. However, in the case of incorrect hours being entered, changes can be made for 60 minutes after the initial change has been made – regardless of the number of hours entered. Once the 60 minutes has expired, and either of the total hourmeters reaches 25 hours, no further changes are allowed.

e. Your computer may now be disconnected and turned off or you can continue setting up the configurations.

5.6.7 Configuration/IntelliSet PC Card

a. Place the START/RUN-OFF switch in the OFF position to power down the microprocessor and to take it out of Configuration mode.

b. Power the microprocessor up by either turning the START/RUN-OFF switch to the START/RUN position (OK to place in Manual Start Operation if desired), or by inserting a PC mode jumper into the download port.

c. Insert your Configuration PC card into the PC card slot in the microprocessor and watch the MessageCenter. When the MessageCenter shows "CFG, = TO LOAD, ↑ TO CANCEL," press the = key. It will take 10 – 15 seconds to load the IntelliSets off the card. "LOADING INFO" will be displayed during this time. When finished, the MessageCenter will show "ALL INFO LOADED – REMOVE CARD." Remove the Configuration PC card.

d. When the PC card is removed, the MessageCenter will show
"MICRO WILL RESET AND RESTART NOW."

NOTE

Units with IntelliSet will NOT START UNTIL an IntelliSet is selected. The MessageCenter will show "PRESS ↑ ↓ TO VIEW INTELLISETS" will flash continuously until an IntelliSet is selected.

e. Press the = key to display the #1 IntelliSet. (Enable IntelliSet at = key must be configured ON. See Section 5.2.1.) OR press the SELECT key until PRESS ↑ ↓ TO VIEW INTELLISETS is displayed. Pressing the Up Arrow key will bring the first IntelliSet name into the Message Center.

f. The first IntelliSet will appear in the MessageCenter. Press either the UP or Down Arrow keys to move through the IntelliSet List. Move to the desired IntelliSet and press the = key. The desired IntelliSet is automatically active.

5.6.8 Microprocessor Final Checkout

a. Start the unit and allow it to run for a few minutes.

b. While the unit is running, scroll through the Data List of the microprocessor. Verify that all the data that was recorded in Step b. of Section 5.6.1 is now accurately displayed in the Data List. Also, verify that the correct date and time is being displayed.

c. Initiate a Pretrip test. Allow the unit to complete the Pretrip and check for any alarms. Make any necessary repairs before returning the unit into service.

SECTION 6

MessageCenter

6.1 MessageCenter MESSAGES

The following table lists all of the messages that do not appear in other lists in this manual and a description of their meaning. Refer to Section 7 for a list of alarm messages. Refer to Section 3.13 for a list of Unit Data messages. Refer to Section 3.15 for a list of Functional Parameter messages. Refer to Section 5.2.1 for a list of Configuration messages.

MessageCenter MESSAGES	
Message	Description
↑↓ TO SCROLL, THEN = TO LOCK	This message is used when viewing Unit Data. Use the UP & DOWN arrow keys to move through the data list. Press the = key to lock a data item in the MessageCenter
↑↓ TO SCROLL, THEN = TO SAVE	Press the UP or DOWN arrow keys to scroll through menu selections available in this mode. When you reach the desired selection, press the = key to store new value in microprocessor's memory.
↑↓ TO SCROLL, THEN = TO SELECT	Press the UP or DOWN arrow keys to scroll through menu selections available in this mode. When you reach the desired selection, press the = key to select it.
= TO INSTALL, INSTALLS LEFT XX	An Option PC card has been inserted into the PC card slot. Press = to install the option into the Micro. The number of installs remaining on the PC card will be shown.
ACTIVE	This message will appear in the MessageCenter along with the current Intelligent indicating that the IntelliSet is active and none of its settings have been modified.
ACTIVE ALARM LIST CLEARED	The list of active alarms in the Micro Alarm has been erased. (This does *not* remove alarms from the data recorder.)
ALL ALARMS CLEARED	The list of active and inactive alarms in the Micro Alarm lists have been erased. (This does *not* remove alarms from the data recorder.)
ALL INFO LOADED – REMOVE CARD	All data has been loaded into the Micro from the PC card. The card may be safely removed from the Micro.
ARL LIGHT OFF IN X MINS	The Auto Restart Light circuit to the Operator's Light Bar has been energized in Component Test mode. The ARL circuit will continue to be energized for the number of minutes shown.
BACK TO CONFIGS	Pressing the = key with this message showing will return the user to the main Micro Configuration list.
BACK TO FUNC PARAMS	Pressing the = key with this message showing will return the user to the main Functional Parameter list.
BAD PC CARD OR CARD SLOT	The Micro has detected a problem with either the PC card or the PC card slot.
BUZZER OFF IN X MINS	The Buzzer circuit has been energized in Component Test mode. The Buzzer circuit will continue to be energized for the number of minutes shown.
CALIBRATION UNSUCCESSFUL	Attempt to calibrate discharge transducer failed.
CANNOT ENTER TRIP START	Cannot enter trip start. A problem has been detected within the DataRecorder.
CANNOT START DEFROST CYCLE	Cannot start defrost cycle. Refer to Defrost Sections 3.9, 4.4.8, 2.14 and 8.25.
CANNOT START PRETRIP	Cannot start pretrip. Refer to Pretrip Section 3.3.
CANNOT DOWNLOAD – BATTERY DEAD	Data cannot be downloaded and software upgrades are prohibited when battery voltage is below 7.0 volts. This message will be displayed until the serial cable is removed.
CARD FULL, REMOVE CARD	The PC Download card is full. There is no additional room to download the Micro. You may safely remove the PC card from the slot.
CARD LOCKED – REMOVE CARD	The lock switch on the PC card is in the "Locked" position. To use the PC card, move the switch to the "Unlocked" position.

MessageCenter MESSAGES	
Message	Description
CARD REMOVED, DATA NOT COPIED	The PC card was removed before all data recorder data was copied onto the card.
CARD REMOVED, REINSERT CARD	The PC card was removed from the card slot before the operation was completed. Reinsert the PC card into the card slot to perform the operation.
CFG: =TO LOAD,↑ TO CANCEL	A Configuration card has been inserted into the PC card slot. Press = to load configurations or IntelliSets into microprocessor.
CHANGE INTELLISET TO EXIT	The unit is operating in Sleep mode and IntelliSleep is active.
CHARGE MODE – HOLD=TO EXIT	Service mode has the refrigeration system set so that it can be charged with refrigerant through the king valve. Press the = key to manually exit, or wait until the charging is complete.
CHECK AT NEXT SERVICE INTERVAL	The unit needs to be checked at next service interval. There is currently an active non-shutdown alarm in the Alarm list.
CHECK COOLANT LEVEL	The engine coolant level is not full.
CHECK DOOR	Door switch indicates that trailer or rail car compartment door is not closed.
CHECK ENGINE OIL LEVEL	The oil level in the diesel engine is low.
CHECK FUEL LEVEL	The level in the fuel tank is very close to empty.
CHECK MICROPROCESSOR	There is a communication signal lost between the keypad/display and the micro. Check and test the wiring to the keypad/display
CHK WIRES FROM MICRO TO KEYPAD	There is a communication signal lost between the keypad/display and the micro. Check and test the wiring to the keypad/display
CLHR OFF IN X MINS	The Clutch Relay circuit has been energized in Component Test mode. The Clutch Relay circuit will continue to be energized for the number of minutes shown.
COMPONENT TEST MODE	Pressing = while this message is being displayed will allow user access to Component Test mode.
COMPONENT TEST MODE MENU SELECTIONS	The selections following this message will be the components available for energizing during Component Test mode.
CONFIG ERROR, REMOVE CARD	There was an error configuring the Micro with the Configuration PC card. Remove the PC card from the slot.
CONFIGS COMPLETE,= TO EXIT	The user has reached the end of the Configurations list. Pressing the ↑ or ↓ arrow keys will start list over. Press = to exit Configuration list.
CONFIGURATION MODE	Press = to enter Configuration mode.
CONFIGURATION NOT CHANGED	New configuration selection was not entered (saved).
CONTINUOUS LOCKED	The current setpoint is within a range that has been locked into the Continuous Run mode. Start-Stop can not be selected.
CONTINUOUS RUN MODE SELECTED	The unit operating mode has been changed from Start-Stop to Continuous Run.
COPY COMPLETE, REMOVE CARD XX	A DownLoad PC card has been inserted into the PC card slot, and all data from the data recorder has been copied onto the PC card. You may safely remove PC card from the slot. XX=number of empty download slots remaining on the card.
COPY ERROR, REMOVE CARD XX	A DownLoad PC card has been inserted into the PC card slot and an error occurred while the data was being copied onto the PC card. You may safely remove the PC card from the slot. XX=number of empty download slots remaining on the card.
COPYING DATA – PLEASE WAIT	A DownLoad PC card has been inserted into the PC card slot and all data from the data recorder is being copied onto the PC card. DO NOT REMOVE THE CARD WHILE THIS MESSAGE IS BEING DISPLAYED.
DATA RECORDER FAILURE	The controller has stopped recording unit data.
DEFROST CYCLE STARTED	The unit has gone into defrost.

MessageCenter MESSAGES	
Message	Description
DOOR OPEN	The trailer or rail compartment door is open.
DOOR OPEN – LOW SPEED	The trailer or rail compartment door is open forcing the unit to run in low speed.
ENTERING SERVICE MODE	The initial message for Service mode. See Section 5.2.3.
EVAC / CHARGE MODE	The unit is in Service Mode, and the refrigeration system is ready to be evacuated or changed with refrigerant. See section 5.2.3.
EXITING PRETRIP MODE	Pretrip has been aborted either by user or by a pretrip alarm.
EXITING SERVICE MODE	Service mode has been turned off and unit is returning to normal operation.
FUNCTION NOT CHANGED	The = key was not pressed in the allotted amount of time to select the new Functional Parameter setting. The new setting was not stored and the old setting will be used.
HOUR METERS NOT CHANGED	Indicates that no changes have been made to the hourmeters in either the configuration or functional parameter lists.
INACTIVE ALARMS IN MEMORY	There are inactive alarms in the Micro Alarm list which have not yet been cleared out.
INSTALLED, REMOVE CARD XX	An Option PC card has been inserted into the PC card slot, and the option has been installed in the Micro. The PC card may safely be removed from the slot. XX indicates number of option installations remaining on card.
INSTALLING OPTION, PLEASE WAIT	An Option PC card has been inserted into the PC card slot, and the option is being installed in the Micro. DO NOT REMOVE THE CARD WHILE THIS MESSAGE IS BEING DISPLAYED.
INSTALL STOPPED, REINSERT CARD	An Option PC card has been inserted into the PC card slot, and the install process has been stopped been stopped by the PC card not being fully inserted in the slot or by being removed. Remove and reinsert PC card to continue.
KEYPAD LOCKED – BATTERY TOO LOW	Once the battery voltage goes below 7.0 Volts for 10 seconds, all of the keys on the keypad will be locked.
LIST END, = TO CLEAR ALARMS	You have reached the end of the Alarm list. Pressing the = key will clear the Alarm list.
LOADING INFO	A Configuration PC card has been inserted into the PC card slot, and information from the Configuration card is being loaded into the Micro. DO NOT REMOVE THE CARD WHILE THIS MESSAGE IS BEING DISPLAYED.
MAIN MENU	Consists of Configuration mode, Component Test mode and Service modes.
MANUAL START MODE SELECTED	The user has selected manual start mode. The diesel engine must be started using the manual GLOW / CRANK switch. This is available only on units that have a Glow Crank Switch.
MAX SETPOINT HAS BEEN REACHED	Maximum setpoint allowed by configuration settings has been reached.
MIN SETPOINT HAS BEEN REACHED	Minimum setpoint allowed by configuration settings has been reached.
MODIFIED	This message will appear in the MessageCenter along with the current IntelliSet indicating that the IntelliSet is active and one or more of its settings have been modified.
NEW SW: = TO LOAD, TO ↑ CANCEL	A Program PC card has been inserted into the PC card slot, and the program on the PC card is a newer version than what is already loaded in the Micro. Press = to load the program.
NO ACTION TAKEN, REMOVE CARD	A Program PC card has been inserted into the PC card slot, and no key presses have been made to install the program into the Micro. The PC card may be safely removed from the slot.
NO ACTIVE ALARMS	There are no active alarms in the Micro Alarm list.

MessageCenter MESSAGES	
Message	Description
NO DATA ON CARD, REMOVE CARD	A Program or Configuration PC card has been inserted into the PC card slot, and no valid data is present on the PC card. The PC card may safely be removed from the unit.
NO DATA TO COPY, REMOVE CARD	A Download PC card has been inserted into the PC card slot, and there is no valid data in the data recorder to copy onto the PC card. The PC card may safely be removed from the unit.
NO INACTIVE ALARMS	There are no inactive alarms in the Alarm list
NO INSTALLS LEFT, REMOVE CARD	An Option PC card has been inserted into the PC card slot and all install options have been used. The PC card may safely be removed from the unit.
OLD INTELLISETS – USE REEFERMAN	The IntelliSets that are on the Configuration PC Card were written with too old of a PC Program, like ServiceManager. The software in the micro requires IntelliSets to be written to the Configuration PC Card using ReeferManager. Rewrite the information to the card using ReeferManager, then use it in the micro again.
OLD SW, = CANNOT LOAD – REMOVE CARD	A Program PC Card has been inserted into the PC Card slot, and the major version of the program on the PC Card is an older version than what is already loaded in the Micro. Software with older major versions can not be loaded into the Micro. Remove the PC Card. (Refer to Section 5.4.1 for software version description.)
OLD SW, = TO LOAD, ↑ TO CANCEL	A Program PC Card has been inserted into the PC Card slot, and the minor version of the program on the PC Card is an older version than what is already loaded in the Micro. Press = to load the older program. (Refer to Section 5.4.1 for software version description.)
PC MODE	START/RUN-OFF switch is OFF, the PC mode Jumper is connected and engine is not running in order to enter PC mode.
PM DUE	Preventative Maintenance is now due on the unit.
PM HOUR METER NOT CHANGED	The last change for the PM hourmeter was not received by the micro.
PRESS ↑↓ TO VIEW DATA	Press the up or down arrow key to scroll through the Data list.
PRESS ↑↓ TO VIEW SETTINGS	Press the up or down arrow key to scroll through Functional Parameter settings
PRESS ↑↓ TO VIEW PRINT MENU	Press the up or down arrow key to view the strip print setup menu.
PRESS = TO MARK TRIP START	Press the = key to mark the start of the trip in the data recorder.
PRESS = TO START PRETRIP	Press the = key to begin pretrip tests.
PRESS ↑↓ TO VIEW INTELLISET	Press the ↑ or ↓ keys to view IntelliSet list.
PRETRIP FAIL & COMPLETED	Some of the pretrip tests did not pass.
PRETRIP FAIL IN TEST XX	Some of the pretrip tests did not pass and the pretrip was not completed.
PRETRIP PASS	All of the pretrip tests were OK.
PRODUCT SHIELD: HIGH AIR ON	When unit is equipped with IntelliSet and ProductShield and the unit is running in the High Air Mode.
PRODUCT SHIELD: WINTER ON	When unit is equipped with IntelliSet and ProductShield and the unit is running in Winter Mode.
PRODUCT SHIELD: ECONO ON	
RECOVER / LEAK CHK / EVAC MODE	This message will be displayed when the unit is in Service mode and the CSMV is open to 100%.
REMOVE CARD – BATTERY TOO LOW	If a PC card is inserted when battery is below 7.0 volts this message will be displayed until card is removed.
REMOTE SWITCH 1 (2) OPEN	Remote switch is open. May be connected to a trailer or rail car compartment door or a remote control switch.
REMOTE SWITCH 1 (2) OPEN – LOW SPEED	Shows that the remote switch is open and that the unit is running in low speed. Switch may be connected to a trailer or rail car compartment door or a remote control switch.

MessageCenter MESSAGES	
Message	Description
REMOVE JUMPER	The Configuration / Technician Test mode has been entered. Remove the jumper wire before continuing.
SAME SW, = TO LOAD, ↑ TO CANCEL	A Program PC card has been inserted into the PC card slot, and the program on the PC card is the same as the program currently in the Micro. Press = to reload the same program.
SERVICE MODE	Selection in Configuration and Technician Test Modes which is used when servicing the refrigeration system. See Section 5.2.3.
SETPOINT CHANGED	The new setpoint has been entered (saved into Micro memory). The new setpoint will be used.
SETPOINT NOT CHANGED	The new setpoint has NOT been entered (NOT saved into Micro memory). The old setpoint will be used.
SETTING SMV: XXX %	The START/RUN-OFF position has been placed in the START/-RUN position and the power is up and CSMV is opening.
SLEEP MODE, OFF / ON TO WAKE	The unit is cycled off in Sleep mode. Turn the START/RUN-OFF switch OFF, then back ON to wake the Micro up.
SLEEP WARNING: DOOR OPEN	The rail unit is in Sleep Mode and a rail car compartment door is open. The unit will start as needed for Sleep Mode.
SLEEP WARNING: NO TEMP CONTROL	The unit is running in Sleep mode.
SLEEP WARNING: REMS1(2) OPEN	The rail unit is in Sleep mode and a remote switch is open. Switch may be connected to a door or a remote control switch. The unit will start as needed for Sleep mode.
SMV CLOSING: WAIT xxx SECONDS	Power Up and CSMV is closing. XX is number of seconds remaining until valve is fully closed.
START MODE: AUTO or MANUAL	This Data Message tells the user if the unit is in Auto Start or Manual Start mode
START-STOP LOCKED	The setpoint has been locked into the Start-Stop mode. Continuous Run can not be selected.
START-STOP MODE SELECTED	The unit operating mode has been changed from Continuous Run to Start-Stop.
STATUS OK	The unit is working just great.
TEST #1 to #16	Pretrip is currently running this test and is x% complete
TIME SELECTION NOT CHANGED	A time change was started but not entered in Configuration list.
TRIP START ENTERED	The Trip Start marker has been placed in the data recorder.
UNIT BATTERY DEAD	Battery voltage is less than 7.0V
UNIT SHUTDOWN – DOOR OPEN	The unit has shut down because the trailer or rail compartment door is open.
UNIT SHUTDOWN – SEE ALARM LIST	An active shutdown alarm has shut the unit down
UNIT SHUTDOWN – RMS1(2)	The unit has shut down because switch is open. May be connected to a door or a remote control switch.
UNKNOWN CARD – REMOVE CARD	A defective or different type of PC Card has been inserted into the PC Card slot. The Micro can not recognize any data on the card. The card may be safely removed from the Micro.
WARNING: NO TEMP CONTROL	Both RAT and SAT alarms are on and unit is running with a setpoint in the frozen range in low speed six cylinder cool.
WRONG UNIT TYPE, REMOVE CARD	A Configuration PC Card has been inserted into the PC Card slot. The unit model type on the PC card is not in the same unit family type as the controller. The card may be safely removed from the Micro

SECTION 7

ALARM TROUBLESHOOTING

7.1 INTRODUCTION TO ALARM TROUBLE-SHOOTING GUIDE

The Alarm Troubleshooting Guide should be used whenever an alarm occurs. Alarms will appear in the MessageCenter and will begin with the alarm number. Alarms are listed in the Troubleshooting Guide by alarm number.

When an alarm occurs, look through both Active and Inactive Alarm lists in the microprocessor (see Note 1 Section 7.2) and make note of all alarms.

Before beginning to actually troubleshoot a unit, visually inspect the unit, in particular the area of the unit that is causing a problem. In many cases the cause of the problem will be obvious, once a visual inspection is performed. For those cases where the cause of the problem is not obvious, this troubleshooting guide will be of assistance.

Usually you should begin troubleshooting with the first alarm that appears in the active Alarm list. Other alarms in the list may have contributed to the occurrence of the first alarm. The first alarm that appears is the last alarm that was recorded.

The check items in the troubleshooting guide are listed in order of their likeliness of occurrence and ease of testing. We recommend that you follow the order in which they are presented; however, there may be times when situations or experience directs you to use a different order. For example, if the trailer or rail car is loaded, you may want to perform all the condensing unit checks first, even though some evaporator section checks may be listed before them.

As you go through the troubleshooting steps, you will find the cause of the problem. When you find and correct the problem, it is not necessary to continue through the remainder of the steps. Some active alarms will clear (inactivate) themselves automatically once the cause has been corrected. You then only need to go to the inactive list to clear all alarms before verifying the remainder of the unit operation. Alarms that do not inactivate themselves automatically must be cleared manually. (See Note 1 Section 7.2)

When you are finished making repairs, run the unit through a pretrip cycle and verify that no further active alarms occur. Also, both Alarm lists should be cleared so that there are no 'old' alarms in memory when the unit leaves your repair facility.

If the message **CHECK MICROPROCESSOR** appears in the MessageCenter, there is a communication error between the Keypad and the microprocessor. With no communication, there will not be an associated alarm. Should this occur, check the wire connections for the wiring that connects connector 6 on the microprocessor to the connector at the Keypad / Display assembly.

In later model units this message will read "CHK WIRES FROM MICRO TO KEYPAD."

When working on the refrigeration system, an accurately calibrated manifold test set should always be installed. It is also a good idea to connect an additional high pressure gauge to the king valve.

In high or low ambients, it may be necessary to cool or warm the box temperature before performing specific tests providing that the trailer or rail compartment is not loaded with perishable product.

⚠ WARNING

Beware of V-belts and belt driven components as the unit may start automatically. Before servicing unit, make sure the START/RUN-OFF switch is in the OFF position or the unit is in the Maintenance mode. Also disconnect the negative battery cable.

⚠ WARNING

UNITS EQUIPPED WITH STAR-TRAK TWO WAY COMMUNICATION CAPABILITIES MAY HAVE THE ABILITY TO BE STARTED OR TURNED OFF REMOTELY REGARDLESS OF THE SETTING OF THE START/RUN-OFF SWITCH.

The unit is controlled locally and there can be no two-way communication when the Mode switch on the Remote Monitoring Control Box is in MAINTENANCE MODE. Therefore, when performing any work on the unit, place the Mode switch in MAINTENANCE MODE. After the unit is serviced, return the Mode switch to REMOTE ON. (Refer to Section 3.19.3 for more detailed information on two-way communication.)

7.2 NOTES

Note 1 Active alarms will always be in the Alarm list. They will have an "A" in front of the alarm number. Active alarms may be inactivated by going to the end of the Active Alarm list. "LIST END, = TO CLEAR ALARMS" will appear in the MessageCenter. Pressing = will clear or inactivate the alarms. This moves the alarm to the Inactive Alarm list, *if* the condition that caused the alarm has been corrected. When Shutdown Alarms are cleared, the unit will attempt to restart (if the micro is set for auto-start). When non-Shutdown Alarms are cleared, there will be no noticeable change in the unit's operation.

The Inactive Alarm list is reached by first pressing and holding the Alarm list key, then the UP Key, and holding both of them for six seconds. Alarms in this list will begin with "I" (Inactive) followed by the alarm number.

Clearing alarms from the Inactive Alarm list will also clear alarms from the Active Alarm list. Go to the end of the Inactive Alarm List. "LIST END, = TO CLEAR ALARMS" will show in the Message Center. Press = to clear all alarms from both lists.

Note 2 For units with a Glow/Crank switch, refer to steps 4, 5 and 10.

Note 3 To test electrical circuits when unit is without a glow crank switch, locate the 3 "extra" wires inside the control panel that were used to connect to the glow crank switch before April, 2007. Use either a jumper wire to energize the circuits, or connect a temporary GCS into the circuit to continue.

Note 4 To test electrical circuits when the unit is equipped with a glow crank switch, place the unit in Manual Start Operation.

To do this, first turn the unit off. Press and hold the Glow/Crank switch in the Glow position. Place the Start/Run-Off Switch in Start/Run position. Continue to hold the Glow/Crank switch until the setpoint and box temperature are shown in the display, then release it. The MessageCenter will show "Manual Start Mode Selected", and the Run Relay will be energized. See Unit non-running amps below for current draw in this state.

Note 5 Many checks will be made with the microprocessor powered up, but with no outputs to the unit components. The unit may be put into PC Mode to do this. For additional information see PC Mode – Section 5.1.

For units with a Glow/Crank switch, an alternative method to power up the microprocessor with no load, hold the Glow/Crank switch in the glow position, and place the START/RUN-OFF switch in START/RUN. Continue to hold the Glow/Crank switch for two seconds after the self test begins, then release. This is before the setpoint and box temp values are show. The Message Center will show "Manual Start Mode Selected," however no electrical circuits will be energized. Current draw in this state is 0 ± 0.5 Amps.

Note 6 Sensors and sensor circuits may be tested at the 1MP plug. Remove plug from microprocessor and using the 1MP Plug Map and an ohmmeter, test resistance of circuits. (See Section 8.29 for chart of resistances for different sensors.)

Note 7 When checking the Defrost Air Switch, RPM Sensor [non–Electronic Speed Control (ESC) Engine Only], Engine Oil Level Switch, Door Switch, or HPS, unplug 2MP at the microprocessor. Using the 2MP Plug Map and wiring diagram, check for voltage at the appropriate terminal.

Note 8 When checking the Defrost Air switch, RPM Sensor (Standard Engine Only), Engine Oil Level switch, Door switch, or HPS, unplug 2MP at the microprocessor. Using the 2MP Plug Map and wiring diagram, check for voltage at the appropriate terminal.

Note 9 When checking the light bar, Solenoid Valves & Unloader circuits, unplug 3MP at the microprocessor. Using the 3MP Plug Map and wiring diagram, check for voltage at terminal of the circuit you are testing. Should be battery voltage.

Note 10 Some tests can only be conducted with the unit operating. The unit may be started automatically by placing the START/RUN-OFF switch in the START/RUN position. Units with a Glow/Crank switch can be started manually by pressing and holding the Glow/Crank switch in the Glow position. Place the START/RUN-OFF switch in START/RUN. Continue to hold the Glow/Crank switch until the setpoint and box temperature are shown in the display, then release it after glowing the engine for the appropriate time required for the ambient temperature. The MessageCenter will show "Manual Start Mode Selected." Hold the Glow/Crank switch in the Crank position until the engine starts.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
7.3 DRIVER/OPERATOR ALARMS			
1 LOW FUEL LEVEL WARNING (for units with Low Fuel Level 0% to 100% Sensor / fuel level is displayed in Data list) • TRIGGER ON: Fuel level is 15% or less for more than 30 seconds. • UNIT CONTROL: Alarm only • RESET CONDITION:Auto reset when the fuel level is above 17% for more than 30 seconds, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.			
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for low fuel level**	
		a. Check fuel level in the fuel tank	Add fuel as needed to the fuel tank.
	2	**Check fuel level sensor**	
		a. Inspect fuel level sensor& connector pins & terminals	No physical damage to switch. No damaged or corroded pins in plug.
		b. Check fuel level sensor operation	Place START/RUN-OFF switch in START/RUN position.
		c. Check for voltage at harness plug between pins for BLACK (SP24) negative and RED (SPK5) positive wires	Voltage should be approximately12VDC.
		d. Check for voltage at harness plug between pins for BLACK (SP24) negative and WHITE (1MP26)	Voltage should be greater than 0 VDC and less than 5 VDC, unless the probe is completely dry.
		e. Check continuity of the wire from the harness plug, pin C to the microprocessor plug 1MP26	Place Start-Run/Off Switch in OFF position prior to checking for continuity. Must be less than 10 ohms.
	3	**Check fuel level sensor calibration**	
		a. Check fuel level sensor calibration	See Section 8.5.1
	4	**Check circuits with test (substitute) sensor**	
		a. Substitute known good sensor and clear alarm. Start unit and run for 30 seconds.	Alarm should not come on. (Install new sensor)
		b. Check to see if alarm re-occurs.	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
1	**LOW FUEL LEVEL WARNING (for units with Low Fuel Level switch/no fuel level display in Data list** • TRIGGER ON: Fuel level is less than 1/8 of a tank for more than 30 seconds. • UNIT CONTROL: Alarm only • RESET CONDITION: Auto reset when fuel level is above 1/4 tank for more than 30 seconds. Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for low fuel level**	
		a. . Check fuel level in the fuel tank	Add fuel as needed to the fuel tank.
	2	**Check fuel level switch**	
		a. . Inspect fuel level switch & connector pins & terminals	No physical damage to switch. No damaged or corroded pins in plug.
		b. .Check fuel level switch operation	Place unit in Component Test Mode – Run Relay On, or in Manual Start Mode (see Note 4). DO NOT START UNIT.
		c. .Check for voltage at harness plug between pins A and B	Voltage should be approximately 12VDC at harness plug between pins A and B.
		d. .Check continuity of the wire from the harness plug, pin C to the microprocessor plug 2MP04	Place START/RUN-OFF switch in OFF position prior to checking for continuity. Must be less than 10 ohms.
	3	**Check circuits with test (substitute) switch**	
		a. Substitute known good sensor and clear alarm. Start unit and run for 30 seconds.	Alarm should not come on. (Install new switch if necessary)
		b. Check to see if alarm re-occurs.	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
2	**LOW ENGINE OIL LEVEL** • TRIGGER–ON: Engine oil level is sensed approx. 7 or more qts. (6.62 or more liters) low for longer than 30 seconds. • UNIT CONTROL: Alarm Only, or may be configured to shut unit down on some models. • RESET CONDITION: Auto reset if engine oil level is above 4 qt. (3.79 liters) low for more than 30 seconds or alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check engine oil level**	
		a. Check engine oil dipstick	Add engine oil as needed to fill.
	2	**Check engine oil level switch**	
		a. Inspect engine oil level switch & connector pins & terminals	No physical damage to switch. No damaged or corroded pins in plug.
		b. Check engine oil level switch operation	Contacts open when level is more than 7 qts low Contacts closed when level is less than 4 qts low
	3	**Check engine oil level switch harness**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
		b. Check for shorted circuit in harness, and continuity through the harness	Place unit in PC mode, or in Manual Start mode (see Note 4.) DO NOT START UNIT. Battery voltage reading (12-13 VDC) between wires in plug
	4	**Check oil level switch**	
		a. Drain oil level to approximately 2.8 to 3-4 quarts (3.8 liters) low. Remove switch.	
		b. Visually and physically inspect upper and lower float stops.	Must be securely fastened to center rod.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
3	**LOW COOLANT LEVEL** • TRIGGER ON: Engine coolant level is 1 or more quarts (.95 or more liters) low for more than 30 seconds. • UNIT CONTROL: Alarm only • RESET CONDITION: Auto reset if engine coolant level is at the full mark for more than 30 seconds. Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for low coolant level**	
		a. Check engine coolant level in the coolant bottle	Add coolant as needed to the coolant reservoir and to the fill tube on the radiator
		b. Check coolant hoses for leaks or breaks	Repair all leaks and breaks as necessary Add coolant as needed to the coolant reservoir and to the fill tube on the radiator
	2	**Check Engine Coolant Level switch**	
		a. Inspect engine coolant level switch & connector pins & terminals	No physical damage to switch. No damaged or corroded pins in plug.
		b. Check harness wiring to plug.	Verify wires are in correct plug orifice.
		c. Check engine coolant level switch operation	Place unit in Component Test mode, Run Relay On or in Manual Start mode (see Note 4). DO NOT START UNIT.
		d. Check for voltage at harness plug between pins A and B	Voltage should be 12 volts at harness plug between pins A and B.
		e. Check continuity of the wire from the harness plug, pin C to the microprocessor plug 2MP15	Place Start-Run/Off switch in OFF position prior to checking for continuity. Must be less than 10 ohms.
	3	**Check circuits with test (substitute) switch**	
		a. Substitute known good sensor and clear alarm. Start unit and run for 30 seconds.	
		b. Check to see if alarm re-occurs.	Alarm should not come on. (Install new sensor)

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
7.4 SHUTDOWN ALARMS			
11	**LOW ENGINE OIL PRESSURE** • TRIGGER–ON: Engine oil pressure is below 12 PSIG (0.82 Bar) for longer than five seconds while the engine is running. • UNIT CONTROL: Unit Shutdown & Alarm. • RESET CONDITION: Auto Reset after 15 minutes or, alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the active alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for low engine oil level alarm**	
		a. Check for alarm 2	Alarm conditions must be corrected and the alarm cleared to continue
		b.Check engine oil level	Oil must be in safe range on dipstick
	2	**Check engine oil pressure switch**	
		a. Inspect switch & connector pins & terminals	No physical damage to switch. No damaged or corroded pins in plug.
		b. Check engine oil switch operation.	Contacts closed when oil pressure is above 15 PSIG (1.02 Bars) Contacts open when oil pressure is below 12 PSIG (0.82 Bar)
	3	**Check engine oil switch harness**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
		b. Check for shorted circuit in harness, and continuity through the harness	START/RUN-OFF switch in START/RUN position, Manual Start mode (See Note 4) or PC mode Battery voltage reading (12-13 VDC) between wires in plug
	4	**Check engine oil pressure**	
		a. Connect mechanical oil gauge	Oil pressure must be greater than 15 PSIG (1.02 Bars)
		b. Check engine oil level	Oil must be in safe range on dipstick

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
12	**HIGH COOLANT TEMPERATURE**		
	• TRIGGER–ON: For ambient temperatures below 120°F (48.9°C) Engine coolant temperature is above 230°F (110°C), or Ambient temperatures above 120°F (48.9°C), engine coolant temp is over 241°F (116°C), or Engine coolant temperature is between 230°F and 241°F (110°C and 116°C) for more than five minutes. • UNIT CONTROL: Unit Shutdown & Alarm. • RESET CONDITION: Auto Reset after 15 minutes if the engine coolant temp falls below 212°F (100°C), or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check coolant level.**	
		a. Check coolant level in overflow bottle	Level must be in the Normal range.
		b. Check coolant level in radiator **Do not remove the cap from a hot radiator; if the cap must be removed, do so very slowly in order to release the pressure without spray.**	Level must be at the top of the radiator fill tube.
	2	**Check freeze point of coolant.**	
		a. Use Coolant tester to check concentration of anti-freeze mixture.	Must be between 40% to 60% Ethylene Glycol to water mixture.
	3	**Check airflow through radiator / condenser coil**	
		a. Inspect condenser & radiator fins	Fins must be straight. 90% or more of the coil surface must be undamaged. No “dead” air spaces. Condenser / Radiator coil must be clean.
	4	**Check condenser & water pump belts**	
		a. Check upper fan belt tension & condition.	(Refer to Section 8.7 for belt tensions) No Glazing, no cracking, no slipping
		b. Check lower fan belt tension & condition.	
		c. Check radiator fan belt.	
		d. Check water pump belt tension & condition.	
	5	**Check engine cooling system.**	
		a. Compare actual engine temperature to the microprocessor reading	Temperature must be within ±20°F (±11.1°C).
		b. Test operation of engine coolant thermostat	(Refer to Section 2.6 for coolant thermostat specifications)
		c. Check water pump operation	Must not leak, impeller attached tightly to shaft
		d. Check water pump bypass hose to thermostat housing for internal blockage	Must be clear and open.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
13	**HIGH DISCHARGE PRESSURE** • TRIGGER–ON: Compressor discharge pressure is over 465 PSIG (31.6 Bars) • UNIT CONTROL: Immediate Unit Shutdown & Alarm • RESET CONDITION: Auto Reset after 15 minutes if the compressor discharge pressure falls below 350 PSIG (23.8 Bars), or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**If alarm occurs during Pretrip Test 11, 12 or 13**	
		a. Check discharge snubber tee	Remove and inspect tee. If snubber restrictor is in place, remove it, reinstall tee, and re-test for alarm.
		b. Check SV1 for opening.	During pretrip tests 11, 12 and 13, SV1 may be energized for 1 second to reduce head pressure during tests. If SV1 fails to actually open during the 1 second that it is de-energized, this alarm may occur. Repair SV1 as needed.
	2	**Check fan belts**	
		a. Check upper fan belt tension & condition	(Refer to Section 8.7 for belt tensions) No Glazing, no cracking, no slipping
		b. Check lower fan belt tension & condition.	(Refer to Section 8.7 for belt tensions) No Glazing, no cracking, no slipping
	3	**Check Wiring**	
		a. Visually Inspect wiring to HPS, SV4, & both Compressor Unloaders	Wires must be connected properly & securely to each component
	4	**Check airflow through condenser coil**	
		a. Inspect condenser / radiator fins	Fins must be straight. 90% or more of the coil surface must be undamaged. No “dead” air spaces. Condenser / Radiator coil must be clean.
		b. Check airflow (with unit running).	Even airflow through the entire coil No “dead” spots
	5	**Check system pressures**	
		a. Install Manifold Test Set and check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading on gauges & on micro display. Pressures must be in the normal range for ambient & box temperature conditions.
	6	**Check for refrigerant overcharge**	
		a. Check refrigerant level in the receiver tank.	Level must be between upper & lower sight glasses
	7	**Check HPS switch**	
		a. Inspect switch & connector pins & terminals	No physical damage to switch. No damaged or corroded pins in plug.
		b. Check switch operation (Refer to Section 2.10 for pressure settings)	Contacts open when compressor discharge pressure is above cut-out point ± 10 PSIG (±0.68 Bar) Contacts closed when compressor discharge pressure is below cut-in point ± 10 PSIG (±0.68 Bar)
		Additional steps on the next page.	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
13	**HIGH DISCHARGE PRESSURE (Continued)**		
	8	**Check HPS switch harness**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
		b. Check for shorted circuit in harness, and continuity through the harness	START/RUN-OFF switch in START/RUN position, Manual Start mode (See Note 4) Battery voltage reading (12-13 VDC) between wires in plug
	9	**Perform Pretrip Check**	
		a. Run Pretrip & check for alarms	Any active alarms must be corrected and cleared before proceeding.
	10	**See Refrigeration Trouble Shooting Section 9.3**	Discharge Pressure must be in normal range for the current ambient and box temperature conditions.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
15	**BATTERY VOLTAGE TOO HIGH** • TRIGGER–ON: Voltage at the microprocessor is greater than 17 VDC. • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Reset after 15 minutes when the voltage at the microprocessor is between 11 – 14 VDC, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check battery voltage**	
		a. Test voltage at battery with unit off.	Must be between12-16 VDC
		b. Test voltage at battery with unit running.	Must be between12-16 VDC
	2	**Check alternator voltage**	
		a. Test voltage at alternator output terminal with unit off	Must be between 12-16 VDC
		b. Test voltage at alternator output terminal with unit running.	Must be between 12-16 VDC
	3	**Check voltage at microprocessor**	
		a. Check voltage reading at microprocessor input (QC1+ to QC2-)	START/RUN-OFF switch in START/RUN position, Manual Start mode (See Note 4) Must be between 12-16 VDC
		b. Check voltage reading on microprocessor display	Must be within 0.5 VDC of reading obtained in 3 Amp (above)
16	**BATTERY VOLTAGE TOO LOW** • TRIGGER–ON: Voltage at the microprocessor is less than 10 VDC (except when the engine starter is engaged) • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Reset after 15 minutes when the voltage at the microprocessor is between 11 – 14 VDC, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for Alternator Not Charging Alarm**	
		a. Check for alarm 51	Alarm conditions must be corrected and the alarm cleared to continue
	2	**Check battery voltage**	
		a. Inspect battery cable ends and posts	Must be clean and tight
		b. Test voltage at battery with unit off.	Must be above 11 VDC
		c. Test voltage at battery with unit running.	Must be above 11 VDC
		d. Test specific gravity of battery	(Check for battery specifications)
		e. Perform load test on battery (Follow battery manufacturer's procedure)	(Check for battery specifications)
	3	**Check voltage at microprocessor**	
		a. Check voltage reading at microprocessor input (MPQC1+ to MPQC2-).	START/RUN-OFF switch in START/RUN position, Manual Start mode (See Note 4) Must be above 11 VDC
		b. Check voltage reading on microprocessor display	Must be within .5 VDC of reading obtained in 3a (above)

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
17		**HIGH COMP DISCHARGE TEMP**	
		• TRIGGER–ON: Ambient temp below 120°F (48.9°C) discharge temp was between 310°F – 349°F (154.4°C – 176.7°C) for three minutes, or Ambient temp above 120°F (48.9°C) Discharge temp was between 340°F – 349°F (171.1°C – 176.7°C) for three minutes, or Discharge temp ever reaches 350°F (176.7°C) • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Reset after 15 minutes with Ambient temp below 120°F (48.9°C) the discharge temp falls below 300°F (148.8°C), or Auto Reset after 15 minutes with Ambient temp above 120°F (48.9°C) the discharge temp falls below 330°F (65.4°C), or Alarm may be manually reset via keypad or by turning the unit off, then back on again.	
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**If alarm occurs during Pretrip**	
		a. Pump down low side of refrigeration system.	Verify that system will pump down to 0 PSIG and will hold without leak-back.
	2	**Check refrigerant charge**	
		a. Check for undercharged system	Level must be above lower sight glass
	3	**Check airflow through condenser coil**	
		a. Inspect condenser / radiator fins	Fins must be straight. 90% or more of the coil surface must be undamaged. No “dead” air spaces. Condenser / Radiator coil must be clean.
		b. Check airflow (with unit running).	Even airflow through the entire coil No “dead” spots
	4	**Check system pressures**	
		a. Install Manifold Test Set and check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading on gauges & on micro display.
	5	**Check DTT2**	
		a. Visually inspect the mounting and orientation of DTT2	Must be mounted tightly to the evaporator section, with the long flat surface of DTT2 in contact with the metal surface.
		b. Verify the temperature of DTT2.	Use a test temperature reading device (infrared, independent thermometer, etc.) to verify that DTT2 temperature is the same as that being displayed in the Unit Data list. (Refer to Section 3.13.)
	6	**Perform Pretrip Check**	
		a. Run Pretrip & check for alarms	Any active alarms must be corrected and cleared before proceeding.
	7	**Check compressor reed valves & gaskets**	
		a. Remove compressor heads & inspect condition of all reeds & gaskets	Must be in good condition.
		Additional steps on the next page.	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
17	**HIGH COMP DISCHARGE TEMP (Continued)**		
	8	**Check Expansion Valve (TXV)**	
		a. Visually inspect valve	Bulb must be clamped tightly on the suction line and insulated. No physical damage to bulb, capillary tube of valve body.
		b. Check MOP of valve	Refer to Section 2.10
		c. Check superheat of valve	Refer to Section 2.10
	9	**Check system for non-condensables**	
		a. Check refrigeration system for non-condensable gas(es)	No non–condensable gas(es) may be present.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
18	**LOW REFRIGERANT PRESSURE**		
	• TRIGGER–ON (A): Suction Pressure is less than -6 inHg (-0.2 Bar) for more than 120* seconds, when the RAT is above -10°F (-23.3°C), or If the Suction Pressure is less than -16 inHg (-0.41 Bar) for more than 120*seconds at any RAT temperature, • UNIT CONTROL: Alarm Only or Unit Shutdown & Alarm (if configured) • RESET CONDITION: Auto Reset after 15 minutes if Suction Pressure is more than -4 inHg (-0.41 Bar), or if RAT falls below -10°F (-23.3°C), or Alarm may be manually reset via keypad or by turning the unit off, then back on again. * Time may be set from 0 – 255 seconds in the configuration list. Refer to section 5.2.1.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check fan belts**	
		a. Check upper fan belt tension & condition	(Refer to Section 8.7 for belt tensions) No Glazing, no cracking, no slipping)
		b. Check lower fan belt tension & condition.	(Refer to Section 8.7 for belt tensions) No Glazing, no cracking, no slipping
	2	**Check system pressures**	
		a. Install Manifold Test Set and check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction pressure must be above 3 PSIG (0.2 Bar) Suction & Discharge Pressures must have the same reading on gauges & on micro display.
	3	**Check refrigerant charge**	
		a. Check for undercharged system	Level must be above lower sight glass
	4	**Manually defrost unit**	
		a. Defrost unit and terminate automatically.	Typical defrost cycle time is 5-20 minutes Suction pressure should rise gradually during cycle.
	5	**Check evaporator air flow**	
		a. Check evaporator fan clutch	Must be engaged
		b. Check evaporator section, blower wheel, return air bulkhead, air chute, and cleanliness of evaporator coil	Good Air Flow Return air not restricted Air chute in good condition No damage to blower wheel Evap. coil clean
	6	**Perform Pretrip Check**	
		a. Run Pretrip & check for alarms	Any active alarms must be corrected and cleared before proceeding.
	7	**Check Expansion Valve (TXV)**	
		a. Visually inspect valve	Bulb must be clamped tightly on the suction line and insulated
		b. Check MOP of valve	Refer to Section 2.10
		c. Check superheat of valve	Refer to Section 2.10

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
19	**LOW FUEL SHUTDOWN (for units with Low Fuel Level 0% to 100% Sensor / fuel level is displayed in Data list)** • TRIGGER ON: Fuel level is 10% or less for more than 1 minute. • UNIT CONTROL: Unit shutdown and Alarm. • RESET CONDITION: Auto reset when fuel level is above 12% for more than 1 minute, or alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for low fuel level warning alarm**	
		a. Check for alarm 1	Must be cleared.
		b. Check fuel level intake	Must be above 1/4 tank. Fill as needed.
	2	**Check accuracy of sensor**	
		a. Verify sensor accuracy	See Section 8.5 for sensor testing and calibration. Must be calibrated accurately.
		b. Check wiring to sensor	No physical damage to sensor. No damaged or corroded pins.
	3	**Check fuel level sensor harness**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
		b. Check for shorted circuit in harness, and continuity through the harness	START/RUN-OFF switch in START/RUN position, Manual Start mode (See Note 4) Battery voltage reading (12-13 VDC) between wires in plug
19	**LOW FUEL SHUTDOWN (for units with Low Fuel Level Switch / no fuel level display in Data list)** • TRIGGER ON: Alarm 1 (LOW FUEL LEVEL) has been on past the allowed run time (See chart below) • UNIT CONTROL: Unit shutdown and Alarm. • RESET CONDITION: Auto reset when fuel level is above 1/4 tank for more than 30 seconds or Alarm may be manually reset via keypad or by turning the unit off, then back on again. 30 gal. Fuel tank 30 Minutes 50 gal. Fuel tank 60 Minutes 75 gal. Fuel tank 90 Minutes 100 gal. Fuel tank 120 Minutes 120 gal. Fuel tank 150 Minutes		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for low fuel level warning alarm**	
		a. Check for alarm 1	Must be cleared.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
20	**MAXIMUM COMPRESSOR ALARMS** • TRIGGER ON: One of the following alarms: 13 – High Discharge Pressure 17 – High Compressor Discharge Temperature 18 – Low Refrigerant Pressure 27 – High Suction Pressure 28 – Check Refrigerant System 29 – Check Heat Cycle 56 – Check Evaporator Airflow has occurred three times during the last two hours of actual unit operation (off cycle time is not included), AND this alarm (Alarm 20) has been enabled in this microprocessor ("Test 6" or "Compressor Alarm Shutdown" appears in the Installed Options List in Unit Data), AND Compressor Alarm Shutdown in the configuration list has been set to YES. (Refer to Section 3.13. for information on Unit Data list) • UNIT CONTROL: Unit shutdown and Alarm. • RESET CONDITION: This alarm can only be cleared from the Inactive Alarm list. It can not be cleared from the Active Alarm list, and it will not clear when the START/RUN-Stop switch is turned Off then On again. This is so that drivers and other operators can not reset the alarm. The unit MUST be taken to a repair shop for inspection and repair.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for trigger on alarms**	
		a. Check the Active Alarm list to see which of the following alarms is also present: A13, A17, A18, A27, A28, A29, A56	See steps for the active alarm so that the alarm can be cleared. All Alarm(s) from the above list must be cleared to continue. Reset Alarm 20 from the Inactive Alarm list.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
27	**HIGH SUCTION PRESSURE** • TRIGGER ON: Suction pressure has been greater than 98 PSIG (6.7 Bars) for more than 10 minutes • UNIT CONTROL: Alarm Only or Unit Shutdown & Alarm (if configured) • RESET CONDITION: Auto reset when suction pressure is less than 75 PSIG (5.1 Bars) for five minutes if configured for alarm only,or Auto Reset after 15 minutes if configured as a Shutdown Alarm or, Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check system pressures**	
		a. Check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading ± 5 PSIG (±0.34 Bar) on gauges & on micro display.
	2	**Check compressor drive coupling**	
		a. Verify that compressor coupling is intact, and that the compressor crankshaft is turning.	Compressor crankshaft must be turning.
	3	**Perform pretrip check**	
		a. Run Pretrip & check for alarms	Any active alarms must be corrected and cleared before proceeding.
	4	**Check compressor reed valves & gaskets**	
		a. Remove compressor heads & inspect condition of all reeds & gaskets	Must be in good condition.
	5	**Check compressor pistons and connecting rods.**	
		a. Check compressor pistons and connecting rods.	Must be in good condition.
	6	**See Refrigeration Trouble Shooting Section 9.3**	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
28	**CHECK REFRIGERATION SYSTEM** • TRIGGER ON: Discharge pressure is not at least 5 PSIG (0.34 Bar) higher than Suction pressure for more than 10 minutes • UNIT CONTROL: Alarm Only or Unit Shutdown & Alarm (if configured) • RESET CONDITION: Auto reset when discharge pressure is more than 20 PSIG (1.36 Bars) above the suction pressure for five minutes, or alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check system pressures**	
		a. Check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading – ± 5 PSIG (±0.34 Bar) – on gauges & on micro display.
	2	**Check compressor drive coupling**	
		a. Verify that compressor coupling is intact, and that the compressor crankshaft is turning.	Compressor crankshaft must be turning.
	3	**Perform pretrip check**	
		a. Run Pretrip & check for alarms	Any active alarms must be corrected and cleared before proceeding.
	4	**Check compressor reed valves & gaskets**	
		a. Remove compressor heads & inspect condition of all reeds & gaskets	Must be in good condition.
	5	**Check compressor pistons and connecting rods.**	
		a. Check compressor pistons and connecting rods.	Must be in good condition.
	6	**See Refrigeration System Troubleshooting, Section 9.3.**	
29	**CHECK HEAT CYCLE** • TRIGGER ON: The unit has been operating in the heat cycle for more than 5 minutes, and the SAT is more than 5.5°F (3°C) colder than the RAT constantly for more than 60 seconds. (Unit is actually cooling the air going through the evaporator). • UNIT CONTROL: Unit shutdown and alarm. • RESET CONDITION: Auto reset after 15 minutes or alarm may be manually reset via keypad or by turning the START/RUN-OFF switch OFF and then back On again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Perform pretrip check**	
		a. Run Pretrip & check for alarms	Any active alarms must be corrected and cleared before proceeding.
	2	**See Troubleshooting, Section 9.3. – Refrigeration System Not Heating**	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
7.5 START UP ENGINE ALARMS			
30	**FAILED TO RUN MINIMUM TIME** • TRIGGER–ON: Engine has shut down on an alarm 3 times without having run for at least 15 minutes between each shutdown (not including Door or Remote switch shut downs). • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Alarm may be manually reset via keypad or by turning the unit off, then back on again. If Unit Operation mode is set for Rail, this alarm will automatically reset after 4 hours.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for alarms**	
		a. Check for shut down alarms	Alarm conditions must be corrected and the alarm(s) cleared to continue.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
31	**FAILED TO START – AUTO MODE** • TRIGGER–ON: Engine has tried to start three times unsuccessfully in the auto start mode. • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for flash code on Engine Speed Control Unit (ENSCU) (Applies to ESC engines only).**	
		a. Check for flash codes on the ENSCU.	Refer to Electronic Speed Control Diagnostic tables – Figure 9–1 thru Figure 9–4. There must be no LED flashing alarm codes occurring to continue.
	2	**Check fuel level in tank.**	
		a. Check fuel gauge on tank.	Fill tank as needed.
	3	**Check fuel level in tank.**	
		a. Check fuel gauge on tank.	Fill tank as needed.
	4	**Check for alarms**	
		a. Check for the following alarms: 71 Check for Bad F2 or F3 Fuse alarm 40 Check Glow Plugs alarm 35 Check Starter Circuit alarm	Alarm conditions must be corrected and the alarm cleared to continue
	5	**Check Fuel Solenoid (Applies to non–ESC engines only)**	
		a. Check Run Relay LED	Must be ON.
		b. Check voltage to fuel solenoid	Energize Run Relay in Component Test Mode (Refer to section 5.2.2) to energize the fuel solenoid. Must have 12 VDC between FSC–C (ground) & FSH–A (hold) With Manual Crank Switch in crank position (for units with GCS only) 12 VDC between FSC–C (ground) & FSP–B (pick) For units without GCS, check FSC–B (pick) circuit between fuel solenoid and starter motor.
		c. Inspect solenoid & connector pins & terminals	No damage to solenoid No damaged or corroded pins
		d. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
		e. Check resistance of solenoid	Refer to Section 2.12
		f. Check operation of solenoid	Plunger must move in when energized
	6	**Check fuel system**	
		a. Check fuel system prime	No air in fuel system
		b. Check fuel flow	Unrestricted fuel flow through system
		c. Check voltage to glow plugs	Glow Plug switch ON, Manual Start Mode (units with GCS only) Units without GCS, energize Glow Plug Relay in Component Test Mode (Refer to section 5.2.2) In both cases there must be more than 11 VDC
	7	**Check engine air–intake system**	
		a. Check air filter indicator	Flag must not be visible.
		b. Inspect air intake system	Hoses & tubes in good condition. No kinks or restrictions

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
31	**FAILED TO START – AUTO MODE (Continued)**		
	8	**Check for correct engine oil**	
		a. Check for correct oil viscosity (weight) for conditions	Refer to Section 2.6 Must be correct for ambient conditions
	9	**Check engine exhaust system**	
		a. Inspect the exhaust system	Must be clear and unobstructed
	10	**Check engine**	
		a. Check engine compression	Refer to Section 2.6

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
32	**FAILED TO START – MANUAL** • TRIGGER–ON: The unit was placed in Manual Start mode, and the engine was not manually started within five minutes. or, The user has tried to start the engine three times unsuccessfully in the Manual Start mode. • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Reset by changing to Auto Start mode, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check if unit has a Glow/Crank Switch (GCS).**	
		a. Visually check to see if the unit has a GCS (Units built after April, 2007 do not have this switch). Refer to Section 3.2 for location of switch.	For units with a GCS, continue with Step 2 below. For units without a GCS, check the wiring that would connect to the switch if it were present for shorts. It is not possible to place the unit in Manual Start Mode without energizing this circuit.
	2	**Check for flash code on Engine Speed Control Unit (ENSCU) (Applies to ESC engines only).**	
		a. Check for flash codes on the ENSCU.	Refer to Electronic Speed Control Diagnostic tables – Figure 9–1 thru Figure 9–4. There must be no LED flashing alarm codes occurring to continue.
	3	**Operator failed to crank engine**	
		a. Manually start unit.	Engine starts and runs
	4	**Check fuel level in tank.**	
		a. Check fuel gauge on tank.	Fill tank as needed.
	5	**Check for Check Glow Plugs alarm**	
		a. Check for alarm 40	Alarm conditions must be corrected and the alarm cleared to continue.
	6	**Check manual Glow / Crank Switch (GCS) (Only for units with a GCS)**	
		a. Check the glow/crank switch	No damaged or corroded pins No physical damage
		b. Check voltage to glow/crank switch - Voltmeter lead on - Battery post + Voltmeter lead on switch terminals (With wires connected to switch)	START/RUN-OFF switch in START/RUN position, Manual Start mode (See Note 4) Position / Terminals / VDC Off: 1 — 11 V (min) 2 & 3 — 0 V (min) Glow 1 & 3 — 10 1/2 V (min) 2 — 0 V (min) Disconnect wire to Starter Solenoid before checking: Crank: 1 & 2 — 11 1/2V (min) 3 — 0 V (min)
		c. Check voltage to glow plugs	Glow Plug switch ON, Manual Start mode More than 11 VDC
		d. Check voltage to starter solenoid	Crank switch ON, Manual Start Mode More than 11 VDC
	7	**Check glow/crank switch harness – All Units**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
		Additional steps on the next page.	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
32	**FAILED TO START - MANUAL (Continued)**		
	8	**Check Fuel Solenoid (Applies to non-ESC engines only)**	
		a. Check Run Relay LED	LED 28 must be ON.
		b. Check voltage to fuel solenoid	START/RUN-OFF switch in START/RUN position, Manual Start mode (See Note 4) More than 11 VDC positive and good ground
		c. Inspect solenoid & connector pins & terminals	No damage to solenoid or wires No damaged or corroded pins Wires plugged in
		d. Inspect harness & control box connector pins & terminals (See wiring schematic (See Wiring Schematic Section 10)	No physical damage to harness. No damaged or corroded pins
		e. Check resistance of solenoid	Refer to Section 2.12
		f. Check operation of solenoid	Plunger must move in when energized
	9	**Check fuel solenoid harness**	
		a. Inspect harness & control box connector pins & terminals (See Wiring Schematic Section 10)	No physical damage to harness. No damaged or corroded pins
	10	**Check fuel system**	
		a. Check fuel system prime	No air in fuel system
		b. Check fuel flow	Unrestricted fuel flow through system
		c. Check fuel system check valve from filter to injection pump.	Check valve must hold fuel and not leak back
	11	**Check engine air–intake system**	
		a. Check air filter indicator	Flag must not be visible.
		b. Inspect air intake system	Hoses & tubes in good condition. No kinks or restrictions
	12	**Check for correct engine oil**	
		a. Check for correct oil viscosity (weight) for conditions	Refer to Section 2.6 Must be correct for ambient conditions
	13	**Check engine exhaust system**	
		a. Inspect the exhaust system	Must be clear and unobstructed
	14	**Check engine**	
		a. Check engine compression	Compression must be above 400 PSIG (27.22 Bar)

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
34	**ENGINE FAILED TO STOP** • TRIGGER–ON: Engine is turning more than 500 RPM (or the micro input shows that the engine is turning more than 500 RPM) for 20 seconds after unit was turned off, shut down on an alarm or cycled off in a Start/Stop Off Cycle, or Oil Pressure Switch contacts are closed longer than 20 seconds after unit was turned off, shut down on an alarm, or cycled off in a Start/Stop Off Cycle. • UNIT CONTROL: Alarm Only • RESET CONDITION: Alarm may be manually reset via Keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for engine running**	
		a. Verify that engine is still running.	Engine should not be running.
	2	**Check for Bad Engine RPM Sensor alarm**	
		a. Check for alarm 130	Alarm conditions must be corrected and the alarm cleared to continue
	3	**Check engine oil pressure switch**	
		a. Inspect switch & connector pins & terminals	No physical damage to switch. No damaged or corroded pins in plug.
		b. Check engine oil switch operation.	Contacts closed when oil pressure is above 15 PSIG (1.02 Bars) Contacts open when oil pressure is below 12 PSIG (0.82 Bar)
	4	**Check engine oil switch harness**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
		b. Check for shorted circuit in harness, and continuity through the harness	Start/Run–Off Switch in Start/Run position, Manual Start Mode (See Note 4) (for units with GCS only) For units without a GCS, use Component Test Mode to energize the Run Relay (Refer to Section 5.2.2) Battery voltage reading (12–13 VDC) between wires in plug to Oil Pressure Switch when disconnected from the switch.
	5A.	**Check Fuel and Speed Actuator (FSA) & circuit**	
		a. Check Run Relay LED	LED 28 must be OFF.
		b. Check for 12 VDC on the Run Relay circuit	Must be 0 VDC
		c. Check SPK20 for voltage	Must be 0 VDC
		d. Check ENSCU terminals 13 & 15 for voltage	Must be 0 VDC
		e. Check FSA plunger	Must be free to move
	5B.	**Check fuel solenoid (non–Electronic Speed Controlled (ESC) engines) & circuit**	
		a. Check Run Relay LED	LED 28 must be OFF.
		b. Check voltage at harness to fuel solenoid (non ESC engines)	Must be 0 VDC
		c. Check fuel solenoid plunger	Must be free to move

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
35	**CHECK STARTER CIRCUIT** • TRIGGER–ON: Engine speed failed to reach 50 RPM during 2 start attempts. • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check if unit has electronic speed control flash code.**	
		a. Check for flash codes on the Engine Speed Control Unit (ENSCU).	Refer to Electronic Speed Control Diagnostic tables – Figure 9–1 thru Figure 9–4
		b. Check for voltage at ENSCU terminal 13	Must be above 11.5 VDC
		c. Check for ground at ENSCU terminal 19.	No damage or high resistance.
	2	**Check starter relay circuit**	
		a. Check operation of starter solenoid relay	START/RUN-OFF switch in START/RUN position, Manual Start mode (See Note 4) Relay contacts closed when crank switch is ON
		b. Check relay socket & terminals	No signs of discoloration from overheating No corrosion
		c. Check voltage to Starter Solenoid Relay	Negative lead on 85, Positive lead on 86 = 12 VDC Negative lead on Gnd, Positive lead on 87 & 30 = 12 VDC
		d. Inspect wiring to starter solenoid & starter motor	No physical damage to wiring or battery cable end. No damaged or corroded terminals
		e. Check voltage to starter solenoid	Must be above 11.5 VDC
		f. Check voltage to starter motor	Must be above 10 VDC while cranking
	3	**Check Fuel and Speed Actuator (FSA) & circuit**	
		a. Check Run Relay LED	LED 28 must be ON.
		b. Check for 12 VDC on the Run Relay circuit	Must be 0 VDC
		c. Check SPK20 for voltage	Must be 12 VDC
		d. Check ENSCU terminals 13 & 15 for voltage	Must be 12 VDC
		e. Check FSA plunger	Must be free to move
	4	**Check starter**	
		a. Inspect starter and wiring.	No damage or corrosion Wiring and battery cable must be clean and tight.
		b. Check resistance of solenoid	Refer to Section 2.12
		c. Check resistance of starter motor	Refer to Section 2.12
		d. Test amperage draw of starter.	Refer to Section 2.12
	5	**Check battery voltage**	
		a. Inspect battery cable ends and posts	Must be clean and tight No corrosion
		b. Test voltage at battery with unit off.	Must be above 11 VDC
		c. Test specific gravity of battery	Check
		d. Perform load test on battery (Follow battery manufacturer's procedure)	Check
	6	**Check for correct engine oil**	
		a. Check for correct viscosity for conditions	Refer to Section 2.6 Must be correct for ambient conditions

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
36	**CHECK COOLANT TEMPERATURE** • TRIGGER–ON: Coolant temperature is below 32°F (0°C) after the engine has been running for five minutes. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when Coolant temp rises above 36°F (2.2°C), or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check coolant temperature**	
		a. Check temperature of coolant or upper radiator hose	Must be above 32°F (0°C)
	2	**Check Engine Coolant Sensor**	
		a. Check resistance of Engine Coolant Sensor (See Note 6)	(Refer to Section 2.12 for complete resistance chart) 10k Ohms @ 77°F (25°C)
		b. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
37	**CHECK LOW SPEED RPM**		
• TRIGGER–ON: Controller is set for low engine speed operation, and RPM being read by the microprocessor are not correct. The correct RPM for low speed are different for different models as shown below: Less than 1325 or greater than 1625 for **Ultima XTC and X2 2500A/R**; or Less than 1200 or greater than 1500 for **Ultra XTC and X2 2100A/R** for more than 60 seconds (120 seconds when the microprocessor calls for a change from high speed to low speed, or when the unit first starts) • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if controller is set for low engine speed operation and RPM are: Between 1375 to 1575 for **Ultima XTC and X2 2500A/R**; or Between 1250 to 1400 for **Ultra XTC and X2 2100A/R** for 60 seconds, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.			
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Model Number**	
		a. Verify that the model number on the unit data label matches the model number shown in the micro unit data list.	Enter the correct number in the data list. (Refer to Section 3.13.)
	2	**Check for proper voltage to the Engine Speed Control Unit (ENSCU) pin 22 based on the model. Check for proper voltage with unit running.**	
		a. Ultima XTC and X2 2500A	Verify 0 VDC at terminal 16 of the ENSCU. Verify 12 VDC at terminal 22 of the ENSCU.
		b. Ultra XTC and X2 2100A	Verify 0 VDC at terminal 16 of the ENSCU. Verify 0 VDC at terminal 22 of the ENSCU.
	3	**Check speed solenoid & linkage on non-Electronic Speed Controlled (ESC) engines (Fuel and Speed Actuator on ESC engines**	
		a. Check speed solenoid on standard engines (Fuel and speed actuator on ESC plunger)	Must move in and out freely
		b. Check engine speed arm & linkage	Must move freely
	4	**Force Low Speed operation (See note 10)**	
		a. Using Functional Parameters, set the Low Speed Start Up Delay to 10 minutes.	Unit will run in low speed. RPM must be within range shown above for each specific model. Adjust speed linkage as needed.
		b. Check operation of Speed Relay LED	LED 27 must be OFF.
		c.Check voltage at engine speed control unit (ENSCU) pin 16.	Must be 0 VDC
	5	**Check engine RPM**	
		a. Check actual engine RPM using hand held tachometer	Refer to Section 2.6 Adjust engine linkage setting as needed.
		b. Compare actual RPM with those shown on display.	Both readings within ± 50 RPM
	6	**Check engine air–intake system**	
		a. Check air filter indicator	Flag must not be visible.
		b. Inspect air intake system	Hoses & tubes in good condition. No kinks or restrictions
	7	**Check engine exhaust system**	
		a. Inspect the exhaust system	Must be clear and unobstructed

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
38	**CHECK HIGH SPEED RPM**		
• TRIGGER–ON: Controller is set for high engine speed operation, and RPM being read by the microprocessor are not correct. The correct RPM for low speed are different for different models as shown below: Less than 2000, or greater than 2400 for **Ultima XTC and X2 2500A/R**; or Less than 1500 or greater than 1900 for **Ultra XTC and X2 2100A/R** for more than 60 seconds (120 seconds when the microprocessor calls for a change from low speed to high speed) • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if controller is set for high engine speed operation and RPM are: Between 2050 to 2350 for **Ultima XTC/X2 2500A/R** or; Between 1550 to 1850 for **Ultra XTC/X2 2100A/R** for 60 seconds, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.			
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Model Number**	
		a. Verify that the model number on the unit data label matches the model number shown in the micro unit data list.	Enter the correct number in the data list. (Refer to Section 3.13.)
	2	**Check for proper voltage to the Engine Speed Control Unit (ENSCU) pin 22 based on the model. Check for proper voltage with unit running.**	
		a. Ultima XTC and X2 2500A	Verify 12 VDC at terminal 16 of the ENSCU. Verify 12 VDC at terminal 22 of the ENSCU.
		b. Ultra XTC and X2 2100A	Verify 12 VDC at terminal 16 of the ENSCU. Verify 0 VDC at terminal 22 of the ENSCU.
		c. Check circuit from ENSCU terminal 16 to micro connection MPQC3.	Must be 12 VDC
	3	**Check speed solenoid & linkage on non-ESC engines**	
		a. Check speed solenoid plunger on non ESC engines (Fuel and speed actuator on ESC engines)	Must move in and out freely
		b. Check engine speed arm & linkage (non-ESC engines)	Must move freely
	4A	**Check speed solenoid harness**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins or terminals
		b. Check resistance of speed solenoid (FSA on ESC units)	Refer to Section 2.12. With the FSA disconnected, check the FSA coil resistance. Spec is 3–4 ohms +/– 10%.
		c. Check amp draw of speed solenoid	Refer to Section 2.12. Use Component Test Mode (Refer to Section 5.2.2) to test. Refer to Section 2.12 for amp values. View current draw in the Unit Data List. (Section 3.13)

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
38	**CHECK HIGH SPEED RPM (Continued)**		
	5	**Force High Speed operation (See note 10)**	
		a. Place unit in continuous run and adjust setpoint to at least 15 degrees away from box temperature, and a temperature greater than 20°F (5.6°C). If the unit does not immediately go into High Speed, set the AIRFLOW Functional Parameter to HIGH.	Controller will call for High Speed operation.
		b. Check operation of Speed Relay LED	LED 27 must be ON. (If LED 27 is not on, the microprocessor is not calling for High Speed operation. Check Speed Overrides in section 4.6.1 for more information.)
		c. Check voltage to speed solenoid (On ESC engines, check voltage on the engine speed control unit (ENSCU) pin 16)	Must be 12-14 VDC
	6	**Check engine RPM**	
		a. Check actual engine RPM using hand held tachometer	Refer to Section 2.6 Adjust engine linkage setting as needed.
		b. Compare actual RPM with those shown on display	Both readings within ± 50 RPM
	7	**Check engine air–intake system**	
		a. Check air filter indicator	Flag must not be visible.
		b. Inspect air intake system	Hoses & tubes in good condition. No kinks or restrictions
	8	**Check engine exhaust system**	
		a. Inspect the exhaust system	Must be clear and unobstructed

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
39	**CHECK ENGINE RPM**		
	• TRIGGER–ON: Engine RPM have been: Less than 1200 or greater than 2500 for **Ultima XTC and X2 2500A/R**; or Less than 1100 or greater than 2000 for **Ultra XTC and X2 2100A/R** for more than five minutes • UNIT CONTROL: Alarm Only or Unit Shutdown & Alarm (if configured) • RESET CONDITION: Auto Reset if unit is set for Alarm Only when engine RPM are: Between 1200 to 2500 for **Ultima XTC and X2 2500A/R** or: Between 1100 to 2000 for **Ultra XTC and X2 2100A/R** for more than five minutes, or After 15 minutes if the unit is set for RPM Shutdown or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Model Number**	
		a. Verify that the model number on the unit data label matches the model number shown in the micro unit data list.	Enter the correct number in the data list. (Refer to Section 3.13.)
	2	**Check for flash code on Engine Speed Control Unit (ENSCU) (Applies to ESC engines only).**	
		a. Check for flash codes on the ENSCU.	Refer to Electronic Speed Control Diagnostic tables – Figure 9–1 thru Figure 9–4
	3	**On all units with ESC, refer to Electronic Speed Control Diagnostic tables**	
		a. Check speed solenoid plunger on non ESC engines (Fuel and speed actuator on ESC engines)	Must move in and out freely
		b. Check engine speed arm & linkage	Must move freely
	4	**Check fuel system**	
		a. Check for Alarm 1	Fill tank as needed
		b. Check fuel flow	Unrestricted fuel flow through system Fuel not gelled
		c. Check fuel system prime	No air in fuel system
	5	**Check engine air–intake system**	
		a. Check air filter indicator	Flag must not be visible.
		b. Inspect air intake system	Hoses & tubes in good condition. No kinks or restrictions
		c. Check voltage to speed solenoid	Must be 0 VDC
	6	**Force Low Speed operation (See note 10)**	
		a. Using Functional Parameters, set the High Speed Delay for at least 10 minutes so the unit starts in low speed.	Unit will run in low speed. RPM must be within range shown above for each specific model. Adjust speed linkage as needed.
		b. Check operation of Speed Relay LED	LED 27 must be OFF when the microprocessor is calling for Low Speed.
		c. Check voltage to speed solenoid (FSA voltage cannot be checked on ESC)	Must be 0 VDC
		Additional steps on the next page.	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
39	**CHECK ENGINE RPM (Continued)**		
	7	**Check low speed engine RPM**	
		a. Check actual engine RPM using hand held tachometer	Refer to Section 2.6 Adjust engine linkage setting as needed.
		b. Compare actual RPM with those shown on display	Both readings within ± 50 RPM
	8	**Force high speed operation (See note 10)**	
		a. Place unit in continuous run and adjust set point to at least 15 degrees away from box temperature, and a temperature greater than 20° F (5.6°C) If the unit does not immediately go into High Speed, set the AIRFLOW Functional Parameter to HIGH.	Controller will call for High Speed operation.
		b. Check operation of Speed Relay LED	LED 27 must be ON. (If LED 27 is not on, the microprocessor is not calling for High Speed operation. Check Speed Overrides in section 4.6.1 for more information.)
		c. Check voltage to speed solenoid on standard engines. (FSA voltage cannot be checked on ESC engines.)	Must be 12-14 VDC
	9	**Check high speed engine RPM**	
		a. Check actual engine RPM using hand held tachometer	Refer to Section 2.6 Adjust engine linkage setting as needed.
		b. Compare actual RPM with those shown on display	Both readings within ± 50 RPM

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
40	**CHECK GLOW PLUGS** • TRIGGER–ON: Glow Plug amperage is less than 30 Amps, or greater than 43 Amps after 14 seconds of glow time (NOTE: In auto start, this can only occur when the Engine Coolant Temperature is below 32°F (0°C) and the glow time is configured SHORT.) • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if glow plug amperage is between 30 to 43 amps for at least 14 seconds during the glow cycle, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check glow plug circuit**	
		a. Inspect glow plug relay & socket	No signs of discoloration from overheating No corrosion
		b. Check operation of Glow Plug Relay	START/RUN-OFF switch in START/RUN position-Manual Start Operation. (See Note 4) Glow Crank switch in Glow position OR, use Component Test Mode to energize the Glow Plug Relay. (Refer to Section 5.2.2) LED 30 must be ON
		c. Check Non–Running Amps	View Current Draw in Data list Refer to Section 2.12
		d. Check Glow Plug circuit amperage	Current Draw = Non–Running Amps + Glow Plug Amps In Component Test Mode, only the Glow Plug Amps will be displayed.
		e. Check voltage to glow plugs	Must be 11 VDC or higher
	2	**Check glow plug circuit wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
	3	**Check Glow Plugs**	
		a. Check amp draw of each glow plug	Refer to Section 2.12

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
41	**ENGINE STALLED** • TRIGGER–ON: The engine is running, RPM sensor is good, and engine speed is less than 10 RPM; or The engine is running, RPM sensor alarm is ON, and the Oil Pressure switch contacts are open. • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Restart after 15 minutes, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for Alarm 130 - Check RPM Sensor**	
		a. Check for alarm 130	When Alarms 130 and 41 occur at the same time, generally the engine has run out or is running out of fuel. This causes the engine RPM to surge and drop. Check fuel tank and add fuel as necessary. Check fuel lines between the fuel tank and the fuel pump inlet for drawing air in.
	2	**Check for flash code on Engine Speed Control Unit (ENSCU) (Applies to ESC engines only).**	
		a. Check for flash codes on the ENSCU.	Refer to Electronic Speed Control Diagnostic tables – Figure 9–1 thru Figure 9–4
	3	**Was engine shut off manually?**	
		a. Check for external cause	Correct problem.
	4	**Check for Bad F2 or F3 Fuse Alarm**	
		a. Check for alarm 71	Alarm conditions must be corrected and the alarm cleared to continue.
	5	**Check fuel system**	
		a. Check for Alarm 1	Fill tank as needed
		b.Check fuel flow	Unrestricted fuel flow through system Fuel not gelled
		c. Check fuel system prime	No air in fuel system
		d. Check fuel system check valve from filter to injection pump.	Check valve must hold fuel and not leak back
	6	**Check Fuel Solenoid (non-ESC engines) or Fuel Speed Actuator (ESC engines)**	
		a. Check Run Relay LED	LED 28 must be ON.
		b. Check voltage to fuel solenoid or ESC module.	START/RUN-OFF switch in START/RUN position, Manual Start mode (See Note 4) More than 11 VDC positive and good ground
		c. Inspect solenoid & connector pins & terminals for non–ESC engines __Inspect ESC module connector pins & terminals for ESC engines	No damage to solenoid, Fuel–Speed Actuator, ESC module, or wires No damaged or corroded pins Wires plugged in
		d. Inspect harness & control box connector pins & terminals (See wiring schematic (See Wiring Schematic Section 10)	No physical damage to harness. No damaged or corroded pins
		e. Check resistance of solenoid	Refer to Section 2.12
		f. Check operation of solenoid	Plunger must move in when energized
	7	**Check RPM Sensor (Standard Engines Only)**	
		a. Check Engine RPM in Data list	Must be Steady Accurate Reading
		b. Check wiring from RPM Sensor to Control Box, Connectors and Pins (See Wiring Schematic)	No physical damage to harness No damaged or corroded pins Plug connection fits tightly
		Additional steps on the next page.	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
41	**ENGINE STALLED (Continued)**		
	8	**Check Engine Speed Sensor (ENSSN) (Units With Electronic Speed Control (ESC) engines Only)**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
	9	**Check engine air–intake system**	
		a. Check air filter indicator	Flag must not be visible.
		b. Inspect air intake system	Hoses & tubes in good condition. No kinks or restrictions
	10	**Check engine exhaust system**	
		a. Inspect the exhaust system	Must be clear and unobstructed
	11	**Check engine**	
		a. Check Injection pump timing	Timing must be correct
		b. Check engine valve adjustment	Rocker arm clearance must be correct
		c. Check engine compression	Compression must be above 27.2 Bars (400 PSIG)
	12	**Check refrigeration system**	
		a. Check discharge & suction pressures	Must be within normal operating range for conditions

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
7.6 WARNING / STATUS ALARMS			
51	**ALTERNATOR NOT CHARGING** • TRIGGER–ON: Unit is running (either engine or standby) and the current flow is more than -1.0 Amps (discharge) between the alternator to the battery for three continuous minutes. • UNIT CONTROL: Alarm Only or Unit Shutdown & Alarm (if configured) • RESET CONDITION: Auto Reset (if not shut down) when alternator is charging or alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Microprocessor Current Sensor**	
		a. Check micro Current Value	START/RUN-OFF switch in START/RUN position, Manual Start mode, all electrical circuits off. (See Note 5) Must be -2.0 to 1.5 Amps with no load
		b. Check direction of wire through current sensor.	Must be in correct direction (See arrow on current sensor.)
		c. Check amp current value with 0 amps going through the current sensor.	Disconnect and remove the wire going through the current sensor, then reconnect it to the fuse holder. Power up micro and check CURRENT DRAW in the Unit Data List. The value must be between –1.0 and 1.0 Amps. (Refer to Section 3.13.)
	2	**Check alternator belt**	
		a. Check alternator belt tension & condition	(Refer to Section 8.7 for belt tensions) No Glazing, no cracking, no slipping
	3	**Check alternator wiring**	
		a. Check output & ground wire (unit OFF)	Negative lead on Ground terminal Positive lead on Output terminal = same as battery voltage.
		b. Check exciter wire (if used)	START/RUN-OFF switch in START/RUN position, Manual Start mode (See Note 4) Must have 11 or more VDC with switch ON
	4	**Check AUX (D+) terminal**	Must have less than 3 VDC with unit OFF
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
		b. Check output wire (unit running)	Must have 13 or more VDC (when tested against – battery post)
		c. Check ground wire (unit running)	Must have 13 or move VDC (when tested against + battery post)
	5	**Check for add–on equipment drawing too much current**	
		a. Check amperage of added–on components & accessories	All add–on components & accessories must draw less than 20 Amps
	6	**Perform Pretrip Check**	
		a. Run Pretrip & check for alarms	Any active alarms must be corrected and cleared before proceeding.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
53	**BOX TEMP OUT-OF-RANGE**		
	• TRIGGER–ON: UNIT CONTROL: **Alarm Only:** The box temperature has been in range – within ±2.7°F (±1.5°C) of setpoint for perishable and frozen – at least once since the unit was started (Sleep Model and Component Test Modes excluded), and is now further away from setpoint than the limit set in the functional parameters – 4°, 5.5°, or 7°F (2.°, 3°, or 4°C) for this unit, for more than 15 minutes, or for more than 30 minutes immediately following the end of a defrost cycle. OR If a unit Shutdown alarm occurs and the box temperature is further away from setpoint than the limit set in the functional parameters – 4°, 5.5°, or 7°F (2°, 3° or 4°C) – for more than 30 minutes regardless if the box temperature has been in–range. The box temperature has not been in range, and the unit is operating in Pulldown (Cool) and the DeltaT (SAT minus RAT) is less than 1°F (0.56°C) OR The unit is operating in Pullup (Heat) and the SAT is the same temperature or colder than the RAT for more than 30 minutes. (Alarm 122 – CHECK RETURN AIR SENSOR and Alarm 123 CHECK SUPPLY AIR SENSOR must not be active). **Shut Down & Alarm:** The box temperature has been in range – within ±2.7°F (±1.5°C) – of setpoint for perishable and frozen at least once since the unit was started (Sleep mode, Diagnostic and Component Test modes excluded), and is now further away from setpoint than the limit set in the functional parameters for this unit, for more than 45 minutes • UNIT CONTROL: Alarm Only or Unit Shutdown & Alarm (if configured) • RESET CONDITION: Auto Reset or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check trailer or rail compartment doors**	
		a. Inspect all trailer or rail compartment doors	Must be closed, no air leakage
	2	**Check for low refrigerant pressure alarm**	
		a. Check for alarm 18	Alarm conditions must be corrected and the alarm cleared to continue
	3	**Check system pressures**	
		a. Install Manifold Test Set and check system pressures.	Suction & Discharge Pressures must be in the normal range. Suction & Discharge Pressures must have the same reading on gauges & on micro display.
	4	**Perform pretrip check**	
		a. Run Pretrip & check for alarms	Any active alarms must be corrected and cleared before proceeding.
	5	**Defrost evaporator**	
		a. Initiate Manual Defrost Cycle	Must terminate automatically.
		Additional steps on the next page.	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
53	**BOX TEMP OUT-OF-RANGE (Continued)**		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	6	**Check refrigerant level**	
		a. Visually check refrigerant level in receiver tank.	Must be at correct level.
	7	**Check delta-T**	
		a. Calculate SAT minus RAT, or check delta-T value in Data list.	In cool, SAT must be at least 1°F (0.6°C) than RAT. In heat, SAT must be at least the same temperature as RAT or warmer.
NOTE: The temperature criteria for this alarm is reset, and the box temperature must again go In-Range before this alarm can be triggered if any of the following occur: •Pretrip is started •Setpoint is changed •A door switch or remote switch is installed and configured as a door switch			
NOTE: The 15, 30, or 45 minute timer is reset and starts again whenever: •The unit cycles off and restarts in Start-Stop •The unit goes into and comes out of Defrost **NOTE:** This alarm does not go into the Inactive Alarm list when it becomes inactive or is cleared. **NOTE:** This alarm will not be used in Sleep mode			

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
54	**DEFROST NOT COMPLETE** • TRIGGER–ON: Defrost cycle did not terminate automatically. [DTT2 and SAT did not reach termination temperature of 55°F (12.8°C) within 45 minutes]. • UNIT CONTROL: Alarm Only. While this alarm is active, the Defrost Timer will be temporarily set to initiate a defrost cycle 90 minutes (1.5 hours) of unit running time after the alarm comes on. • RESET CONDITION: Auto Reset when defrost cycle is started again, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check evaporator fan clutch**	
		a. Check Evap Fan Clutch operation in defrost	Must disengage fan.
	2	**Check refrigerant level**	
		a. Visually check refrigerant level in receiver tank.	Must be at correct level.
	3	**Check for low refrigerant pressure alarm**	
		a. Check for alarm 18	Alarm conditions must be corrected and the alarm cleared to continue
	4	**Verify temperature of DTT2**	
		a. Using a service (Test) thermometer check temperature of Evaporator tube sheet at DTT2 and compare with DTT2 temperature in Data list.	Must be within ±2°F (1°C)
		b. Check DTT2 and RAT wiring.	Verify that RAT temperature is being displayed as RAT in unit Data list and that DTT2 is being displayed as DTT2. Correct wiring if required. (Refer to Section 3.13.)
	5	**Check accuracy of DTT2 and SAT temperature readings**	
		a. Check DTT2 resistance, and. Check SAT resistance (See Note 6)	(Refer to Section 2.12 for complete resistance chart) 10K Ohms @ 77°F (25°C)
	6	**Check DTT2 for proper mounting**	
		a. Inspect DTT2	Should be screwed tightly in place. Flat area of DTT2 must be against metal surface.
	7	**Perform pretrip check**	
		a. Run Pretrip & check for alarms	Any active alarms must be corrected and cleared before proceeding.
	8	**See Troubleshooting, Section 9.3.5 – Refrigeration System Not Heating**	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
55	**CHECK DEFROST AIR SWITCH** • TRIGGER–ON: The defrost air switch has called for a defrost cycle within eight minutes of a defrost termination for two consecutive defrost cycles. (The air switch contact must be closed continuously for 15 seconds before the defrost cycle is started.) • UNIT CONTROL: Alarm ON. While this alarm is active, the defrost air switch will NOT be used to initiate a defrost cycle; however the Defrost Timer will initiate a defrost cycle 90 minutes after the alarm comes on, and the manual defrost switch will remain operative. • RESET CONDITION: Auto Reset when defrost cycle terminates correctly, and the air switch does not call for a defrost cycle within the eight minutes following defrost termination, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check defrost air**	
		a. Inspect switch & connector pins & terminals	No damaged or corroded pins
		b. Check defrost air switch setting with Magnehelic Gauge, and check the resistance of switch contacts	Refer to Section 2.10 Contacts closed with pressure applied to high side Contacts open with no pressure applied
	2	**Check switch wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Note 7 No physical damage to harness. No damaged or corroded pins
	3	**Check air switch hoses**	
		a. Inspect air hoses to switch	No kinks or other obstructions No holes Connected to correct nipple
	4	**Check evaporator pressure drop**	
		a. Check pressure reading with Magnehelic Gauge	Refer to Section 2.10
	5	**Check evaporator fan clutch**	
		a. Check Evap Fan Clutch operation in defrost	Must disengage fan.
	6	**Check condition of trailer and rail compartment & load**	
		a. Check condition of trailer and rail compartment doors & seals	Doors must be closed, and door seals must seal and prevent outside air from leaking in.
		b. Check condition of product. If it is warm and moist, frequent defrost cycles can be expected.	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
56	**CHECK EVAPORATOR AIRFLOW**		
	• TRIGGER–ON: In the Cool mode, the Supply Air temperature is 5°F (2.8°C) or more warmer than Return Air Temperature for five minutes; or In the Heat mode, the Suction pressure has been higher than 100 PSIG (6.8 Bars) for more than 60 seconds. **NOTE:** For this alarm the unit must be running. This alarm will not occur in either the Defrost or Pretrip cycles. • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Reset in 15 minutes IF Alarm 30 is not also active or, alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check fan belts**	
		a. Check upper fan belt tension & condition.	(Refer to Section 8.7 for belt tensions) No Glazing, no cracking, no slipping
		b. Check lower fan belt tension & condition.	(Refer to Section 8.7 for belt tensions) No Glazing, no cracking, no slipping
	2	**Check evaporator air flow**	
		a. Check evaporator fan clutch	Must be engaged
		b. Check evaporator section, condition of evaporator blower wheels, return air bulkhead, air chute, cleanliness of evap. coil	Good Air Flow Return air not restricted Air chute in good condition No damage to blower wheel Evap. coil clean
	3	**Check system pressures**	
		a. Install Manifold Test Set and check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading on gauges & on micro display.
	4	**Check refrigerant charge**	
		a. Check for undercharged system	Level must be above lower sight glass
	5	**Perform pretrip check**	
		a. Run Pretrip & check for alarms	Any active alarms must be corrected and cleared before proceeding.
	6	**Check SV4**	
		a. Check SV4 for leakage when closed	Must not leak

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
57	**CHECK REMOTE SWITCH 1**		
	• TRIGGER–ON:Remote Switch 1 is set to trigger alarm (contacts open or contacts closed depending on set up in configuration list for Remote Switch 1) for more than five seconds. **NOTE:** •This alarm is disabled for Shutdown when the 'Unit Operation' configuration is set for Rail and the unit is operating in Sleep Mode •Shut down may be overridden in the Functional Parameter list. • UNIT CONTROL: Alarm Only, or may be configured to shut unit down. • RESET CONDITION: Alarm Only: Auto Reset after Remote Switch 1 has been set to allow unit to run for more than five seconds. Unit Shutdown: Auto Reset after three minutes (minimum off time for Remote switch shutdown condition) and Remote Switch 1 has been set to allow unit to run for more than five seconds.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Determine what Remote Switch 1 is controlled by.**	
		a. Remote Switch 1 may be connected to a trailer or rail compartment door, or some other device and used to remotely control the unit.	Find and locate Remote Switch 1
	2	**Check to see if trailer or rail compartment side or rear door is open, or if the device that Remote Switch 1 is connected to is set to trigger the alarm.**	
		a. Inspect trailer or rail compartment doors	Trailer or rail car compartment door(s) must be closed
		b. Check device at Remote Switch 1	Must have switch in position that allows unit to operate.
	3	**Check wiring**	
		a. Visually inspect wiring to switch	Wiring must be connected
		b. Visually inspect condition of switch	Must not be damaged
	4	**Check Remote Switch 1**	
		a. Check switch operation	Contacts must Open & Close as switch is opened and closed.
	5	**Check configurations**	
		a. Verify that Configuration is set for the type of switch being used (i.e. when Door is open, switch contacts are closed; etc.)	Must be correct for type of Remote switch being used.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
58	**CHECK REMOTE SWITCH 2**		
	• TRIGGER–ON: Remote Switch 2 is set to trigger alarm (contacts open or contacts closed depending on set up in configuration list for Remote Switch 2) for more than five seconds. **NOTE:** •This alarm is disabled for Shutdown when the 'Unit Operation' configuration is set for Rail and the unit is operating in Sleep Mode. •Shut down may be overridden in the Functional Parameter list. • UNIT CONTROL: Alarm Only, or may be configured to shut unit down. • RESET CONDITION: Alarm Only: Auto Reset after Remote Switch 2 has been set to allow unit to run for more than five seconds. Shutdown: Auto Reset after three minutes (minimum off time for Remote switch shutdown condition) and Remote Switch 2 has been set to allow unit to run for more than five seconds.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Determine what Remote Switch 2 is controlled by.**	
		a. Remote Switch 2 may be connected to a trailer or rail compartment door, or some other device and used to remotely control the unit.	Find and locate Remote Switch 2
	2	**Check to see if trailer or rail compartment side or rear door is open, or if the device that Remote Switch 2 is connected to is set to trigger the alarm.**	
		a. Inspect trailer or rail compartment doors	Trailer or rail car compartment door(s) must be closed
		b. Check device at Remote Switch 2	Must have switch in position that allows unit to operate.
	3	**Check wiring**	
		a. Visually inspect wiring to switch	Wiring must be connected
		b. Visually inspect condition of switch	Must not be damaged
	4	**Check Remote Switch 2**	
		a. Check switch operation	Contacts must Open & Close as switch is opened and closed.
	5	**Check configurations**	
		a. Verify that Configuration is set for the type of switch being used (i.e. when Door is open, switch contacts are closed; etc.)	Must be correct for type of Remote switch being used.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
59	**DATALOGGER NOT RECORDING** • TRIGGER–ON: No data is being recorded by the data recorder. • UNIT CONTROL: Alarm Only • RESET CONDITION: Alarm may be manually reset via keypad.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Clear alarm**	
		a. Clear Active Alarm(s)	Alarms Clear
		b. Check for Active Alarm reoccurrence	If Inactive, download all data & retain. If Active, go to next step
	2	**Microprocessor defective**	
		a. Download previous data using Download PC Card, or ReeferManager Program.	Data retrieval OK
		b. Replace microprocessor & set Configurations, Functional Parameters, Enter hours from removed microprocessor, set Maintenance Hour Meters, and Data Recorder Setup.	New microprocessor in place
NOTE: Specific configurations or IntelliSet settings may be found on the TransCentral Website (Authorized Carrier Transicold Dealers only.)			

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
60	**DATALOGGER TIME WRONG** • TRIGGER–ON: The real time clock in the Data Recorder does not contain a valid date. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when the Data Recorder Real Time Clock is reset, or Alarm may be manually reset by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check real time clock**	
		a. Check Real Time Clock in the Data list, or using ReeferManager.	Must show correct date and time. Change as needed (Configuration list).
	2	**Reset microprocessor**	
		a. Turn main switch off for 30 seconds, then turn on.	Microprocessor powers up OK
		b. Check for valid Real Time Clock reading in Data list	Valid date and time in memory. Alarm is cleared automatically
		c. Real Time Clock can not be changed.	Replace microprocessor
	3	**Microprocessor defective**	
		a. Download previous data using Download PC Card, or ReeferManager Program.	Data retrieval OK
		b. Replace microprocessor & set Configurations, Functional Parameters, Enter hours from removed microprocessor, set Maintenance Hour Meters, and Data Recorder Setup.	New microprocessor in place
NOTE: Specific configurations or IntelliSet settings may be found on the TransCentral Website (Authorized Carrier Transicold Dealers only.)			

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
61	**DOOR OPEN**		
	• TRIGGER–ON: Trailer or rail car compartment door has been open for more than five seconds. **NOTE:** •This alarm is disabled for Shutdown when the 'Unit Operation' configuration is set for Rail and the unit is operating in Sleep Mode. •Shut down may be overridden in the Functional Parameter list. • UNIT CONTROL: Alarm Only, or may be configured to shut unit down. • RESET CONDITION: Alarm Only: Auto Reset after the door has been closed for more than five seconds. Shutdown: Auto Reset after three minutes (minimum off time for door open condition) and the door has been closed for more than five seconds.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check to see if trailer or rail compartment side or rear door is open**.	
		a. Inspect trailer or rail car compartment doors	Trailer or rail car compartment door(s) must be closed
	2	**Check wiring**	
		a. Visually inspect wiring to door switch	Wiring must be connected
		b. Visually inspect condition of switch	Must not be damaged
	3	**Check door switch**	
		a. Check switch operation	Contacts must Open & Close as door is opened and closed.
	4	**Check configurations**	
		a. Verify that Configuration is set for the type of switch being used (i.e. when Door is open, switch contacts are closed; etc.)	Must be correct for type of door switch

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
7.7 ELECTRICAL ALARMS			
71	**BAD F2 OR F3 FUSE** • TRIGGER–ON: One or more of the following fuse circuits have been open for more than 2 seconds: F2 (Speed Relay output circuit), or F3 (Run relay output circuit) • UNIT CONTROL: Alarm Only • RESET CONDITION: Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check unit operation**	
		a. Did unit shut down?	Yes Check F3 No Check F2
	2	**Check fuses**	
		a. Locate blown fuse(s)	Will have open circuit
		b. Verify fuse size	Refer to Section 2.11 Must be correct rating for circuit (see wiring diagram)
		c. Inspect fuse & fuse holder	Terminals tight; No signs of overheating, melting or discoloration
	3	**Check circuit**	
		a. Check amperage draw on Speed Relay circuit	Refer to Section 2.12
		b. Check amperage draw on Run Relay circuit	Refer to Section 2.12
72	**BAD F4 OR F6 FUSE** • TRIGGER–ON: One or more of the following fuse circuits have been open for more than 2 seconds: F4 (Clutch Relay output circuit, or F6 (SV & UL valves, Buzzer, & Fuel Heater Relay coil circuit • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Reset when the fuse is replaced, and the unit is powered up, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check fuse**	
		a. Locate blown fuse	Will have open circuit
		b. Verify fuse size	Refer to Section 2.11 Must be correct rating for circuit (see wiring diagram)
		c. Inspect fuse & fuse holder	Terminals tight; No signs of overheating, melting or discoloration
	2	**Check circuit**	
		a. Check amperage draw on clutch circuit	Refer to Section 2.12
		b. Check amperage draw on F6 circuit (See wiring schematic)	Refer to Section 2.12

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
78	**CHECK SV1 CIRCUIT** • TRIGGER–ON: In either the Heat, Null, or Defrost cycles, the SV1 coil circuit is shorted. (The SV1 output from the micro is negative, so the circuit will not be shorted to ground, but is shorted either within the SV1 coil itself, or to a positive wire.) • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when unit calls for Heat or Defrost and the SV1 coil current (amp) draw is normal, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check SV1 coil**	
		a. Inspect SV1 coil & connector pins & terminals	No damage to coil No damaged or corroded pins
		b. Check resistance of coil	Refer to Section 2.12
		c. Check amp draw of coil.	Refer to Section 2.12. Use ammeter
	2	**Check SV1 wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 3, 4 & 9 No physical damage to harness. No damaged or corroded pins
	3	**Check SV1 current draw**	
		a. Use Component Test mode (Refer to Section 5.2.2) to test actual current draw of the circuit.	Refer to Section 2.12 for normal current values. View current draw in Data list
79	**CHECK SV4 CIRCUIT** • TRIGGER–ON: In either the Heat or Defrost cycles the SV4 coil circuit is shorted. (The SV4 output from the micro is negative, so the circuit will not be shorted to ground, but is shorted either within the SV4 coil itself, or to a positive wire. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when unit calls for Heat or Defrost and the SV4 coil current (amp) draw is normal, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check SV4 coil**	
		a. Inspect SV4 coil & connector pins & terminals	No damage to coil No damaged or corroded pins
		b. Check resistance of coil	Refer to Section 2.12
		c. Check amp draw of coil.	Refer to Section 2.12. Use ammeter.
	2	**Check SV4 wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 3, 4 & 9 No physical damage to harness. No damaged or corroded pins
	3	**Check SV4 current draw**	
		a. Use Component Test mode (Refer to Section 5.2.2) and Alarms 81 thru 90 and Alarms 93 and 97 to test actual current draw of the circuit.	Refer to Section 2.12 for normal current values. View current draw in the Unit Data list. (Refer to Section 3.13)

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
81	**CHECK FHR CIRCUIT**		
	• TRIGGER–ON: Fuel Heater Relay circuit is shorted. (The Fuel Heater Relay output from the micro is negative, so the circuit will not be shorted to ground, but is shorted either within the Fuel Heater Relay coil itself, or to a positive wire. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when Fuel Heater Relay current (amp) draw is normal, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check fuel heater relay**	
		a. Inspect Fuel Heater Relay & socket	No damage to relay No damaged or corroded pins
		b.Check resistance of relay coil	Refer to Section 2.12.
	2	**Check fuel heater relay wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 3, 4 & 9 No physical damage to harness. No damaged or corroded pins
	3	**Check fuel heater relay current draw**	
		a. Use Component Test mode (Refer to Section 5.2.2) to test actual current draw of the circuit.	Refer to Section 2.12 for normal current values. View current draw in the Unit Data list. (Refer to Section 3.13).
82	**CHECK REMOTE OUT-RANGE LIGHT**		
	• TRIGGER–ON: The micro Light Bar configuration is set for an 8–LIGHT BAR, and the Out–of–Range light circuit (to the Light Bar) circuit is shorted. (The Out-Of-Range Light output from the micro is negative, so the circuit will not be shorted to ground, but is shorted either within the Out-Of-Range Light itself, or to a positive wire. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when In–range light current (amp) draw is normal, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check out-of-range light**	
		a. Inspect Out-of-Range light & socket	No damage to bulb No damaged or corroded pins
		b. Check resistance of light bulb	Refer to Section 2.12
	2	**Check out-of-range light wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 3, 4 & 9 No physical damage to harness. No damaged or corroded pins
	3	**Check out-of-range light current draw**	
		a. Use Component Test mode (See Section 5.2.5.2.2) to test actual current draw of the circuit.	Refer to Section 2.12 for normal current values. View current draw in the Unit Data list. (Refer to Section 3.13)

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
83	**CHECK REMOTE DEFROST LIGHT** • TRIGGER–ON: The micro Light Bar configuration is set for an 8–LIGHT BAR, and the Defrost light circuit (to the Light Bar) circuit is shorted. (The Defrost Light output from the micro is negative, so the circuit will not be shorted to ground, but is shorted either within the Defrost Light itself, or to a positive wire. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when Defrost light current (amp) draw is normal, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check defrost light**	
		a. Inspect Defrost light & socket	No damage to bulb No damaged or corroded pins
		b. Check resistance of light bulb	Refer to Section 2.12
	2	**Check defrost light wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 3, 4 & 9 No physical damage to harness. No damaged or corroded pins
	3	**Check defrost light current draw**	
		a. Use Component Test mode (Refer to Section 5.2.2) to test actual current draw of the circuit.	Refer to Section 2.12 for normal current values. View current draw in the Unit Data list. (Refer to Section 3.13)
84	**CHECK REMOTE ALARM LIGHT** • TRIGGER–ON: Remote Alarm light circuit (to the Light Bar) circuit is shorted. (The Alarm Light output from the micro is negative, so the circuit will not be shorted to ground, but is shorted either within the Alarm Light itself, or to a positive wire. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when Alarm light current (amp) draw is normal, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check alarm light**	
		a. Inspect Remote Alarm light & socket	No damage to bulb No damaged or corroded pins
		b. Check resistance of light bulb	Refer to Section 2.12
	2	**Check alarm light wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 3, 4 & 9 No physical damage to harness. No damaged or corroded pins
	3	**Check alarm light current draw**	
		a. Use Component Test mode (Refer to Section 5.2.2) to test actual current draw of the circuit.	Refer to Section 2.12 for normal current values. View current draw in the Unit Data list. (Refer to Section 3.13)

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
85	**CHECK UL1 CIRCUIT**		
	• TRIGGER–ON: UL1 (Front) Unloader Coil circuit is shorted. (The UL1 output from the micro is negative, so the circuit will not be shorted to ground, but is shorted either within the UL1 itself, or to a positive wire. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when the UL1 Coil current (amp) draw is normal, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check UL1 (Front) unloader coil**	
		a. Inspect UL1 Unloader coil & terminals	No damage to coil No damaged or corroded pins
		b. Check resistance of coil	Refer to Section 2.12
		c. Check amp draw of coil.	Refer to Section 2.12. Use ammeter.
	2	**Check UL1 unloader coil wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 3, 4 & 9 No physical damage to harness. No damaged or corroded pins
	3	**Check UL1 current draw**	
		a. Use Component Test mode (Refer to Section 5.2.2) to test actual current draw of the circuit.	Refer to Section 2.12 for normal current values. View current draw in the Unit Data list. (Refer to Section 3.13)
86	**CHECK UL2 CIRCUIT**		
	• TRIGGER–ON: UL2 (Rear) Unloader Coil circuit is shorted. (The UL2 output from the micro is negative, so the circuit will not be shorted to ground, but is shorted either within the UL2 itself, or to a positive wire. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when the UL2 Coil current (amp) draw is normal, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check UL2 (Rear) unloader coil**	
		a. Inspect UL2 Unloader coil & terminals	No damage to coil No damaged or corroded pins
		b. Check resistance of coil	Refer to Section 2.12
		c. Check amp draw of coil.	Refer to Section 2.12. Use ammeter.
	2	**Check UL2 coil wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 3, 4 & 9 No physical damage to harness. No damaged or corroded pins
	3	**Check UL2 current draw**	
		a. Use Component Test mode (Refer to Section 5.2.2) to test actual current draw of the circuit.	Refer to Section 2.12 for normal current values. View current draw in the Unit Data list. (Refer to Section 3.13)

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
87	**CHECK REMOTE HEAT LIGHT** • TRIGGER–ON: The micro Light Bar configuration is set for an 8–LIGHT BAR, and the Remote Heat light circuit (to the Light Bar) circuit is shorted. (The Heat Light output from the micro is negative, so the circuit will not be shorted to ground, but is shorted either within the Heat Light itself, or to a positive wire. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when Heat light current (amp) draw is normal, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check heat light**	
		a. Inspect Heat light & socket	No damage to bulb No damaged or corroded pins
		b. Check resistance of light bulb	Refer to Section 2.12
	2	**Check heat light wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 3, 4 & 9 No physical damage to harness. No damaged or corroded pins
	3	**Check heat light current draw**	
		a. Use Component Test mode (Refer to Section 5.2.2) to test actual current draw of the circuit.	Refer to Section 2.12 for normal current values. View current draw in the Unit Data list. (Refer to Section 3.13)
88	**CHECK REMOTE COOL LIGHT** • TRIGGER–ON: The micro Light Bar configuration is set for an 8–LIGHT BAR, and the Remote Cool light circuit (to the Light Bar) circuit is shorted. (The Cool Light output from the micro is negative, so the circuit will not be shorted to ground, but is shorted either within the Cool Light itself, or to a positive wire. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when Cool light current (amp) draw is normal, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check cool light**	
		a. Inspect Cool light & socket	No damage to bulb No damaged or corroded pins
		b. Check resistance of light bulb	Refer to Section 2.12
	2	**Check cool light wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 3, 4 & 9 No physical damage to harness. No damaged or corroded pins
	3	**Check cool light current draw**	
		a. Use Component Test mode (Refer to Section 5.2.2) to test actual current draw of the circuit.	Refer to Section 2.12 for normal current values. View current draw in the Unit Data list. (Refer to Section 3.13)

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
89	**CHECK REMOTE AUTO LIGHT**		
	• TRIGGER–ON: Remote Auto light circuit (to the Light Bar) circuit is shorted. (The Auto Light output from the micro is negative, so the circuit will not be shorted to ground, but is shorted either within the Auto Light itself, or to a positive wire. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when Auto light current (amp) draw is normal, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check auto light**	
		a. Inspect Auto light & socket	No damage to bulb No damaged or corroded pins
		b. Check resistance of light bulb	Refer to Section 2.12
	2	**Check auto light wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 3, 4 & 9 No physical damage to harness. No damaged or corroded pins
	3	**Check auto light current draw**	
		a. Use Component Test mode (Refer to Section 5.2.2) to test actual current draw of the circuit.	Refer to Section 2.12 for normal current values. View current draw in the Unit Data list. (Refer to Section 3.13)
90	**AUTOFRESH AIR EXCHANGE RELAY**		
	• TRIGGER–ON: AutoFresh Air Exchange circuit (to the relay coil) is shorted. (The AutoFresh Air Exchange Relay output from the micro is negative, so the circuit will not be shorted to ground, but is shorted either within the relay itself, or to a positive wire.. Alarm may be manually reset via Keypad or by turning the unit off, then back on again. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when AFEX current (amp) draw is normal, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check AutoFresh Air Exchange Relay (AFAR)**	
		a. Inspect AFAR & socket	No damage to relay No damage to socket
		b. Check resistance of relay coil	Refer to Section 2.12.
	2	**Check AFAR wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 3, 4 & 9 No physical damage to harness. No damaged or corroded pins
	3	**Check AFAR current draw**	
		a. Use Component Test mode (Refer to Section 5.2.2) to test actual current draw of the circuit.	Refer to Section 2.12 for normal current values. View current draw in the Unit Data list. (Refer to Section 3.13)

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
93	**CHECK START UP BUZZER** • TRIGGER–ON: The Buzzer circuit is shorted. (The Buzzer output from the micro is negative, so the circuit will not be shorted to ground, but is shorted either within the Buzzer itself, or to a positive wire. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when Buzzer amp draw is normal, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check buzzer**	
		a. Inspect Buzzer & wire connections	No damage to buzzer No damaged or corroded pins
		b. Check resistance of buzzer	Refer to Section 2.12
	2	**Check buzzer wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 3, 4 & 9 No physical damage to harness. No damaged or corroded pins
	3	**Check buzzer current draw**	
		a. Use Component Test mode (Refer to Section 5.2.2) to test actual current draw of the circuit.	Refer to Section 2.12 for normal current values. View current draw in the Unit Data list. (Refer to Section 3.13)
97	**CHECK SV2 CIRCUIT** • TRIGGER–ON: SV2 coil circuit is shorted. (The SV2 output from the Micro is negative, so the circuit will not be shorted to ground, but is shorted either within the SV2 coil itself, or to a positive wire. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when unit calls for Heat or Defrost and the SV2 coil current (amp) draw is normal, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check SV2 coil**	
		a. Inspect SV2 coil & connector pins & terminals	No damage to coil No damaged or corroded pins
		b. Check resistance of SV2	Refer to Section 2.12
		c. Check amp draw of SV2.	Refer to Section 2.12. Use ammeter.
	2	**Check SV2 wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Notes 3, 4 & 9 No physical damage to harness. No damaged or corroded pins
	3	**Check SV2 current draw**	
		a. Use Component Test mode (Refer to Section 5.2.2) to test actual current draw of the circuit.	Refer to Section 2.12 for normal current values. View current draw in the Unit Data list. (Refer to Section 3.13)

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
7.8 SENSOR ALARMS			
121	**CHECK AMBIENT AIR SENSOR** • TRIGGER–ON: Ambient Air Sensor circuit has failed open or shorted. If shorted, the data list will display 158°F (70°C). If the circuit is open, the data list will show the temperature as -52.6°F (-47°C) • UNIT CONTROL: A default value of 122°F (50°C) will be used for any calculations. • RESET CONDITION: Auto Reset when Ambient Air Sensor is in range or, Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Ambient Air Temperature sensor (AAT)**	
		a. Inspect Ambient Air Sensor & connector	No damage to sensor No damage, moisture, or corrosion in connector
		b. Check Ambient Air Sensor resistance (See Note 6)	(Refer to Section 8.29 for complete resistance chart) 10,000 Ohms @ 77°F (25°C)
	2	**Check ambient air sensor wiring**	
		a. Inspect harness & control box connector pins & terminals. (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
	3	**Check remote sensor/switch connector**	
		a. Locate and inspect 10-way connector for optional sensors and switches.	Connector must have cap on, No corrosion or moisture inside connector. If there is a problem with the connector and there are no remote sensors or switches in the unit, the connector may be removed and each individual wire separated from the others, terminated and insulated with heat shrink.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
122	**CHECK RETURN AIR SENSOR** • TRIGGER–ON: Return Air Sensor circuit has failed open or shorted. If shorted, the data list will display 158°F (70°C). If the circuit is open, the data list will show the temperature as -52.6°F (-47°C) • UNIT CONTROL: Use Supply Air Sensor reading plus 3.6°F (2°C). If Supply Air Sensor Alarm is on, and setpoint is at or below +10.4°F (-12°C), unit will run in Low Speed Cool only. If setpoint is above +10.4°F (-12°C), unit will shut down. • RESET CONDITION: Auto Reset when Return Air Sensor is in range or, Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
	NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.		
	1	**Check Return Air Temperature sensor (RAT)**	
		a. Inspect Return Air Sensor & connector	No damage to sensor No damage, moisture, or corrosion in connector
		b. Check Return Air Sensor resistance (See Note 6)	(Refer to Section 8.29 for complete resistance chart) 10,000 Ohms @ 77°F (25°C)
	2	**Check return air sensor wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
	3	**Check remote sensor/switch connector**	
		a. Locate and inspect 10-way connector for optional sensors and switches.	Connector must have cap on, No corrosion or moisture inside connector. If there is a problem with the connector and there are no remote sensors or switches in the unit, the connector may be removed and each individual wire separated from the others, terminated and insulated with heat shrink.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
123	**CHECK SUPPLY AIR SENSOR** • TRIGGER–ON: Supply Air Sensor circuit has failed open or shorted. If shorted, the data list will display 158°F (70°C). If the circuit is open, the data list will show the temperature as -52.6°F (-47°C) • UNIT CONTROL: Use Return Air Sensor reading minus 3.6°F (2°C). If Return Air Sensor Alarm is on, and setpoint is at or below +10.4°F (-12°C) unit will run in Low Speed Cool only. If setpoint is above +10.4°F (-12°C), unit will shut down. If Alarm 132–CHECK DEFROST TERM 2 SENSOR is also active, Defrost termination will be as described in section 4.4.8. • RESET CONDITION: Auto Reset when Supply Air Sensor is in range or, Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Supply Air Temperature sensor (SAT)**	
		a. Inspect Supply Air Sensor & connector	No damage to sensor No damage, moisture, or corrosion in connector
		b. Check Supply Air Sensor resistance (See Note 6)	(Refer to Section 8.29 for complete resistance chart) 10,000 Ohms @ 77°F (25°C)
	2	**Check supply air sensor wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
	3	**Check remote sensor/switch connector**	
		a. Locate and inspect 10-way connector for optional sensors and switches.	Connector must have cap on, No corrosion or moisture inside connector. If there is a problem with the connector and there are no remote sensors or switches in the unit, the connector may be removed and each individual wire separated from the others, terminated and insulated with heat shrink.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
125	**CHECK COMP DISCH SENSOR** • TRIGGER–ON: Compressor Discharge Sensor circuit has failed open or shorted. If shorted, the data list will display 392°F (200°C). If the circuit is open, the data list will show the temperature as -40°F (-40°C) • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when Compressor Discharge Sensor is in range or, Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Compressor Discharge Temperature sensor (CDT)**	
		a. Inspect Compressor Discharge Sensor & connector	No damage to sensor No damage, moisture, or corrosion in connector
		b. Check Compressor Discharge Sensor resistance (See Note 6)	(Refer to Section 8.29 for complete resistance chart) 100,000 Ohms @ 77°F (25°C)
	2	**Check compressor discharge sensor wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
	3	**Check remote sensor/switch connector**	
		a. Locate and inspect 10-way connector for optional sensors and switches.	Connector must have cap on, No corrosion or moisture inside connector. If there is a problem with the connector and there are no remote sensors or switches in the unit, the connector may be removed and each individual wire separated from the others, terminated and insulated with heat shrink.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
126	**CHECK FUEL SENSOR CIRCUIT** • TRIGGER–ON: The Low Fuel Shutdown is configured as a 0% to 100% sensor, and the fuel level reading (in the data list) is less than 2% for 30 seconds. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when fuel level is sensed above 4% for 30 seconds or, Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for low fuel level**	
		a. Check fuel level in the fuel tank	Add fuel as needed to the fuel tank.
	2	**Check fuel level sensor**	
		a. Inspect fuel level sensor& connector pins & terminals	No physical damage to sensor. No damaged or corroded pins in plug.
		b. Check fuel level sensor operation	Place unit in Manual Start mode (see Note 4), OR Use Component Test Mode to energize the Run Relay. DO NOT START UNIT. (Refer to Section 5.2.2)
		c. Check for voltage at harness plug between pins for BLACK (SP24) and RED (SPK5) wires	Voltage should be 12 volts at harness plug between pins for BLACK (SP24) and RED (SPK5) wires
		d. Check continuity of the wire from the harness plug, pin C to the microprocessor plug 1MP26	START/RUN-OFF switch in OFF position prior to checking for continuity. Must be less than 10 ohms.
		e. With the Fuel Level Sensor reconnected, check the voltage at the microprocessor plug 1MP26	Voltage must be between 0.0 – 5.0 VDC.
	3	**Check fuel level sensor calibration**	
		a. Check fuel level sensor calibration	See Section 8.5
	4	**Check circuits with test (substitute) sensor**	
		a. Substitute known good sensor and clear alarm. Start unit and run for 30 seconds.	
		b. Check to see if alarm re-occurs.	Alarm should not come on. (Install new sensor)

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
129	**CHECK ENG COOLANT SENSOR** • TRIGGER–ON: Engine Coolant Sensor circuit has failed open or shorted. If shorted, the data list will display 266°F (130°C). If the circuit is open, the data list will show the temperature as -58°F (-50°C) • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset when Engine Coolant Sensor is in range or, Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Engine Coolant Temperature sensor (ENCT)**	
		a. Inspect Engine Coolant Sensor & connector	No damage to sensor No damage, moisture, or corrosion in connector
		b. Check Engine Coolant Sensor resistance (See Note 6)	(Refer to Section 8.29 for complete resistance chart) 10,000 Ohms @ 77°F (25°C)
	2	**Check engine coolant sensor wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
	3	**Check remote sensor/switch connector**	
		a. Locate and inspect 10-way connector for optional sensors and switches.	Connector must have cap on, No corrosion or moisture inside connector. If there is a problem with the connector and there are no remote sensors or switches in the unit, the connector may be removed and each individual wire separated from the others, terminated and insulated with heat shrink.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
130	**CHECK ENGINE RPM SENSOR**		
	• TRIGGER–ON: With the unit in Auto Start: The ambient temperature is above 32°F (0°C), and this is the 2nd or 3rd start attempt, and the Engine Oil Pressure switch is closed (oil pressure good), and engine RPM are sensed at less than 1000 RPM; or The ambient is below 32°F (0°C) and the DC amp draw is more than 2 amps , and this is the 2nd or 3rd start attempt, and engine RPM are sensed at less than 1000 RPM; or With the unit in Manual Start: The ambient temperature is above 32°F (0°C), and this is the 2nd or 3rd start attempt, and the Engine Oil Pressure switch is closed (oil pressure good) engine RPM are sensed at less than 50 RPM; or The ambient is below 32°F (0°C) and the DC amp draw is more than 2 amps , and this is the 2nd or 3rd start attempt, and engine RPM are sensed at less than 50 RPM. **NOTE:** This alarm can only be triggered on during the engine starting sequence and the 20 seconds immediately following. • UNIT CONTROL: Alarm Only (Engine will be considered running) • RESET CONDITION: With the unit in Auto Start: Auto Reset in Auto Start when engine RPM are greater than 1,000 or, With the unit in Manual Start: Auto Reset in Auto Start when engine RPM are greater than 1,000 or, when Oil Pressure switch contacts OPEN or, Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for engine stalled alarm**	
		a.Check for A41	When Alarms 41 and 130 occur at the same time, generally the engine has run out or is running out of fuel. This causes the engine to surge. Check fuel tank and add fuel as necessary. Check fuel lines between the fuel tank and the fuel pump inlet for drawing air in.
	2	**Check engine rpm sensor (non–ESC engines only)**	
		a. Inspect Engine RPM Sensor & connector	No damage to sensor. No damage, moisture, or corrosion in connector.
		b. Compare actual engine RPM with those shown on the display using hand held tachometer.	Must be ± 20 RPM Must be a steady reading.
	3	**Check Engine Speed Sensor (ENSSN) (ESC engines Only)**	
		a. Inspect circuit from ENSCU terminal 3 to micro connection 2MP18 & connector.	No damage to unit. No damage, moisture, or corrosion in connector.
		b. Compare actual engine RPM with those shown on the display using hand held tachometer.	Must be ± 20 RPM Must be a steady reading.
		c. Check for 12 VDC between ENSSN 12 V terminal & ENSSN ground.	Must be 12 VDC.
		d. Check for 12 VDC at ENSCU terminal 25 to ground	Must be 12 VDC.
		Additional steps on the next page.	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
130	**CHECK ENGINE RPM SENSOR (Continued)**		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	4	**Check engine RPM sensor wiring (non-ESC engines only)**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	See Note 7 No physical damage to harness. No damaged or corroded pins
		b.Check RPM wiring	Place unit in Manual Start mode (see Note 4), OR Use Component Test Mode to energize the Run Relay. DO NOT START UNIT. (Refer to Section 5.2.2)
		c. Check voltage reading between plug terminals A & B.	With + lead on A and - lead on C reading should be 5 VDC ±.2 volts. If it is not, check for grounded positive circuit at CSP and CDP transducers.
	5	**Check circuits with test sensor**	
		a. Substitute known good sensor and check Unit Data List reading. (Refer to Section 3.13)	Must be within ± 20 RPM or reading on tachometer

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
132	**CHECK DEFROST TERM 2 SENSOR** • TRIGGER–ON: Defrost Termination Temperature Sensor 2 circuit has failed open or shorted. If shorted, the data list will display 158°F (70°C). If the circuit is open, the data list will show the temperature as -52.6°F (-47°C) • UNIT CONTROL: Use RAT or SAT for defrost initiation criteria. (See Defrost mode, Section 4.4.8) • RESET CONDITION: Auto Reset when Defrost Termination Temperature Sensor 2 is in range or, Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Defrost Termination Temperature sensor 2 (DTT2)**	
		a. Inspect Defrost Termination Temperature Sensor 2 & connector	No damage to sensor No damage, moisture, or corrosion in connector
		b. Check Defrost Termination Temperature Sensor 2 resistance (See Note 6)	(Refer to Section 8.29 for complete resistance chart) 10,000 Ohms @ 77°F (25°C)
	2	**Check defrost termination temperature Sensor 2 wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
	3	**Check remote sensor/switch connector**	
		a. Locate and inspect 10-way connector for optional sensors and switches.	Connector must have cap on, No corrosion or moisture inside connector. If there is a problem with the connector and there are no remote sensors or switches in the unit, the connector may be removed and each individual wire separated from the others, terminated and insulated with heat shrink.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
133	**CHECK REMOTE TEMP SENSOR 1** • TRIGGER–ON: Remote Temperature Sensor 1 circuit is configured on, and has failed open or shorted. If shorted, the data list will display 158°F (70°C). If the circuit is open, the data list will show the temperature as -52.6°F (-47°C) • UNIT CONTROL: Alarm only. • RESET CONDITION: Auto Reset when Remote Temperature Sensor 1 is in range or, Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Remote Temperature sensor 1 (REMSN1)**	
		a. Verify that Remote Temperature Sensor 1 has been installed and is correctly wired to the unit.	Remote Temperature Sensor 1 is installed. Wires are connected to 10-pin connector at cavities E & F. If sensor is not present change micro configuration to OFF.
	2	**Check remote temperature sensor 1**	
		a. Inspect Remote Temperature Sensor 1 & connector	No damage to sensor No damage, moisture, or corrosion in connector
		b. Check Remote Temperature Sensor 1 resistance (See Note 6)	(Refer to Section 8.29 for complete resistance chart) 10,000 Ohms @ 77°F (25°C)
	3	**Check remote temperature sensor 1 wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
		b. Check 10-way connector for all remote sensors and switches.	No physical damage, moisture or corrosion to connector. Cavity plugs are in place for unused circuits.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
134	**CHECK REMOTE TEMP SENSOR 2** • TRIGGER–ON: Remote Temperature Sensor 2 circuit is configured on, and has failed open or shorted. If shorted, the data list will display 158°F (70°C). If the circuit is open, the data list will show the temperature as -52.6°F (-47°C) • UNIT CONTROL: Alarm only. • RESET CONDITION: Auto Reset when Remote Temperature Sensor 2 is in range or, Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Remote Temperature sensor 2 (REMSN2)**	
		a. Verify that Remote Temperature Sensor 2 has been installed and is correctly wired to the unit.	Remote Temperature Sensor 2 is installed. Wires are connected to 10-pin connector at cavities G&H. If sensor is not present change micro configuration to OFF.
	2	**Check remote temperature sensor 2**	
		a. Inspect Remote Temperature Sensor 2 & connector	No damage to sensor No damage, moisture, or corrosion in connector
		b. Check Remote Temperature Sensor 2 resistance (See Note 6)	(Refer to Section 8.29 for complete resistance chart) 10,000 Ohms @ 77°F (25°C)
	3	**Check remote temperature sensor 2 wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
		b. Check 10-way connector for all remote sensors and switches.	No physical damage, moisture or corrosion to connector. Cavity plugs are in place for unused circuits.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
135	**CHECK REMOTE TEMP SENSOR 3** • TRIGGER–ON: Remote Temperature Sensor 3 circuit is configured on, and has failed open or shorted. If shorted, the data list will display 158°F (70°C). If the circuit is open, the data list will show the temperature as -52.6°F (-47°C) • UNIT CONTROL: Alarm only. • RESET CONDITION: Auto Reset when Remote Temperature Sensor 3 is in range or, Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Remote Temperature sensor 3 (REMSN3)**	
		a. Verify that Remote Temperature Sensor 3 has been installed and is correctly wired to the unit.	Remote Temperature Sensor 3 is installed. Wires are connected to 10-pin connector at cavities J & K. If sensor is not present change micro configuration to OFF.
	2	**Check remote temperature sensor 3**	
		a. Inspect Remote Temperature Sensor 3 & connector	No damage to sensor No damage, moisture, or corrosion in connector
		b. Check Remote Temperature Sensor 3 resistance (See Note 6)	(Refer to Section 8.29 for complete resistance chart) 10,000 Ohms @ 77°F (25°C)
	3	**Check remote temperature sensor 3 wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
		b. Check 10-way connector for all remote sensors and switches.	No physical damage, moisture or corrosion to connector. Cavity plugs are in place for unused circuits.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
		7.9 PRETRIP ALARMS	
P141	**PRETRIP STOPPED BY USER** • TRIGGER–ON: Pretrip cycle was stopped before the Pretrip cycle ended automatically • UNIT CONTROL: Alarm Only • RESET CONDITION: Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
		NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.	
	1	**Check for any pretrip alarms**	
		a. Scroll the Alarm list for any Active Pretrip alarms	Alarm conditions must be corrected and the alarm cleared to continue
	2	**Rerun pretrip check (if desired)**	
		a. Place into Pretrip mode	Unit running in Pretrip mode
		b. Allow to terminate automatically	Pretrip cycle operates normally.
P143	**CHECK CLUTCH CIRCUIT** • TRIGGER–ON: Normal Amps for the Clutch Circuit is 2.0 to 7 Amps. The circuit tests outside this range. • UNIT CONTROL: Pretrip will abort and “PRETRIP FAILED IN TEST 2” will be displayed in MessageCenter. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
		NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.	
	1	**Check for bad F4 or F6 fuse alarm**	
		a. Check for alarm 72	Alarm conditions must be corrected and the alarm cleared to continue.
	2	**Check clutch**	
		a. Check resistance of clutch coil	Refer to Section 2.12
		b. Check amp draw of clutch coil.	Use Component Test mode (Section 5.2.2) to test. Refer to Section 2.12 for amp values. View current draw in the Unit Data list. (Refer to Section 3.13)
	3	**Check clutch & circuit**	
		a. Inspect clutch and wiring	No damage or corrosion Connector fits together tightly, no moisture inside
		b. Inspect clutch relay & socket	No signs of discoloration from overheating No corrosion
		c. Check operation of Clutch Relay	START/RUN-OFF switch in START/RUN-Manual Start Operation. (See Note 4) LED 29 must be ON
		d. Check voltage to clutch	Must be 11.5 VDC or higher
	4	**Check clutch circuit wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P144	**CHECK UL1 CIRCUIT** • TRIGGER–ON: Normal Amps for the UL1 (Front) Unloader Circuit is 0.75 to 2.0 Amps. The circuit tests outside this range. • UNIT CONTROL: Pretrip will abort and "PRETRIP FAILED IN TEST 2" will be displayed in MessageCenter. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for bad F4 or F6 fuse alarm**	
		a. Check for alarm 72	Alarm conditions must be corrected and the alarm cleared to continue.
	2	**Check UL1**	
		a. Check resistance of UL1 coil	Refer to Section 2.12
		b. Check amp draw of coil.	Use Component Test mode (Section 5.2.2) to test. Refer to Section 2.12 for amp values. View current draw in the Unit Data list. (Refer to Section 3.13).
	3	**Check UL1 & circuit**	
		a. Inspect UL1 and wiring	No damage or corrosion Connector fits together tightly, no moisture inside
		b. Check operation of UL1 FET (23)	START/RUN-OFF switch in Start/Run-Manual Start Operation. (See Note 4) LED must be ON
		c. Check voltage to front unloader	Must be 11 VDC or higher across the 2 wires
	4	**Check UL1 circuit wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P145	**CHECK SPEED SOL CIRCUIT** • TRIGGER–ON: Normal Amps for the Speed Solenoid Circuit is 3.0 to 9.0 Amps for non–Electronic Speed Controlled (ESC) engines or 0 to 1.0 Amps for ESC engines. The circuit tests outsidethis range. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for bad F2 or F3 fuse alarm**	
		a. Check for alarm 71	Alarm conditions must be corrected and the alarm cleared to continue.
	2A	**Check speed solenoid (non-ESC engines)**	
		a. Check resistance of speed solenoid	Refer to Section 2.12
		b. Check amp draw of speed solenoid.	Use Component Test mode (Section 5.2.2) to test. Refer to Section 2.12 for amp values. View current draw in the Unit Data list. (Refer to Section 3.13).
	2B	**Check circuit for high resistance (ESC engines)**	
		a. Check amp draw of engine speed control circuit (ENSCU) pin 16 and MPQC3 on the micro.	Use Component Test mode (Section 5.2.2) to test. Refer to Section 2.12 for amp values. View current draw in the Unit Data list. (Refer to Section 3.13).
	3	**Check speed solenoid & circuit**	
		a. Inspect speed solenoid and wiring	No physical damage to harness. No damaged or corroded pins No damage to solenoid
		b. Check operation of Speed Relay LED	LED 27must be ON
		c. Check voltage to speed solenoid	Must be 11 VDC or higher across the 2 wires
	4	**Check speed solenoid circuit wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P148	**CHECK SV1 CIRCUIT** • TRIGGER–ON: Normal Amps for the SV1 Circuit is 0.75 to 2.5 Amps. The circuit tests outside this range. • UNIT CONTROL: Pretrip will abort and "PRETRIP FAILED IN TEST 2" will be displayed in MessageCenter. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for bad F4 or F6 fuse alarm**	
		a. Check for alarm 72	Alarm conditions must be corrected and the alarm cleared to continue.
	2	**Check SV1**	
		a. Check resistance of SV1	Refer to Section 2.12
		b. Check amp draw of SV1.	Use Component Test mode (Section 5.2.2) to test. Refer to Section 2.12 for amp values. View current draw in the Unit Data list. (Refer to Section 3.13).
	3	**Check SV1 & circuit**	
		a. Inspect SV1 and wiring	No physical damage to harness. No damaged or corroded pins
		b. Start unit, setpoint more than 10°F (5.5°C) above box temperature, and set above +11°F (–11.5°C). (See note 10)	Unit running in Heat Cycle
		c. Check operation of SV1 FET (10)	LED must be ON
		d. Check voltage to SV1	Must be 11 VDC or higher across the 2 wires
	4	**Check SV1 circuit wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P150	**CHECK SV4 CIRCUIT** • TRIGGER–ON: Normal Amps for the SV4 Circuit is 0.75 to 2.0 Amps. The circuit tests outside this range. • UNIT CONTROL: Pretrip will abort and "PRETRIP FAILED IN TEST 2" will be displayed in MessageCenter. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for bad F4 or F6 fuse alarm**	
		a. Check for alarm 72	Alarm conditions must be corrected and the alarm cleared to continue.
	2	**Check SV4**	
		a. Check resistance of SV4	Refer to Section 2.12
		b. Check amp draw of SV4.	Use Component Test mode (Section 5.2.2) to test. Refer to Section 2.12 for amp values. View current draw in the Unit Data list. (Refer to Section 3.13).
	3	**Check SV4 & circuit**	
		a. Inspect SV4 and wiring	No physical damage to harness. No damaged or corroded pins
		b. Start unit with setpoint more than 10°F (5.5°C) above box temperature, and set above +11°F (–11.6°C). (See note 10)	Unit running in Heat Cycle
		c. Check operation of SV–4 FET (9)	LED must be ON
		d. Check voltage to SV–4	Must be 11 VDC or higher across the 2 wires
	4	**Check SV4 circuit wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P151	**CHECK GLOW PLUG CIRCUIT** • TRIGGER–ON: Normal Amps for the Glow Plugs Circuit is 23 to 35 Amps after 15 seconds. The circuit tests outside this range. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check glow plug circuit**	
		a. Inspect glow plug relay & socket	No signs of discoloration from overheating No corrosion
		b. Check operation of Glow Plug Relay	START/RUN-OFF switch in START/RUN-Manual Start Operation. (See Note 4) Glow Crank switch in Glow position. LED 30 must be ON
		c. Check voltage to glow plugs	Must be 11 VDC or higher
		d. Check Glow Plug circuit Amps	Use Component Test mode (Section 5.2.2) to test. Refer to Section 2.12 for amp values. View current draw in the Unit Data list. (Refer to Section 3.13)
		e. Check amp draw of each glow plug.	Refer to Section 2.12 for amp values. Use ammeter.
	2	**Check glow plug circuit wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P152	**CHECK FUEL SOLENOID CIRC**		
	• TRIGGER–ON: Normal Amps for the Fuel Solenoid Hold Circuit is 0.42 to 3.5 Amps (0.2 to 4.5 Amps for ESC units)for non–Electronic Speed Controlled (ESC) engines, and 0.2 to 4.5 Amps for ESC engines (including possible electric fuel pump). The circuit tests outside this range. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for bad F2 or F3 fuse alarm**	
		a. Check for alarm 71	Alarm conditions must be corrected and the alarm cleared to continue.
	2A	**Check fuel solenoid (non–ESC engines only)**	
		a. Check resistance of fuel solenoid	Refer to Section 2.12
		b. Check amp draw of fuel solenoid.	Use Component Test Mode (Section 5.2.2) to test. Refer to Section 2.12 for amp values. View current draw in the Unit Data list. (Refer to Section 3.13)
	2B	**Check fuel and speed actuator (FSA) (ESC engines only)**	
		a. Check resistance of FSA	Refer to Section 2.12. With FSA unplugged, ohm spec is 3–4 ohms, +/– 10%.
		b. Check amp draw between MPQC4 & terminal 13 and 15 of the ENSCU.	Use Component Test Mode (Section 5.2.2) to test. Refer to Section 2.12 for amp values.
	3A	**Check fuel solenoid & circuit (non–ESC engines only)**	
		a. Inspect fuel solenoid and wiring	No physical damage to harness. No damaged or corroded pins No damage to solenoid
		b. Check operation of Run Relay	Start/Run–Off switch in Start/Run–Manual Start Operation. (See Note 2) LED 28 must be ON
		c. Check voltage to fuel solenoid	Start/Run–Off switch in Start/Run, Manual Start Mode (See Note 2) 12 VDC between FSCC (ground) & FSHA (hold) With Manual Crank Switch in crank position 12 VDC between FSCC (ground) & FSPB (pick)
	3B	**Check FSA & circuits (ESC only)**	
		a. Inspect FSA and wiring	No physical damage to harness. No damaged or corroded pins No damage to solenoid
		b. Check operation of Run Relay	Start/Run–Off switch in Start/Run–Manual Start Operation. (See Note 2) LED 28 must be ON
		c. Check voltage to FSA	Start/Run–Off switch in Start/Run, Manual Start Mode (See Note 2) OR component test mode, run relay.12 VDC between engine speed control unit (ENSCU) pins 13 and 19. 12 VDC between ENSCU pins 13 and 19 With Manual Crank Switch in crank position 12 VDC between ENSCU pins 15 and 19
	4	**Check fuel solenoid circuit wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
		b. Check operation of solenoid	Plunger must move in when energized

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P153	**CHECK RETURN AIR SENSOR** • TRIGGER–ON: Return Air Sensor is not within the maximum range of –53°F to +158°F (–47°C to +70°C) • UNIT CONTROL: Pretrip will abort and "PRETRIP FAILED IN TEST 3" will be displayed in MessageCenter. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Return Air Temperature sensor (RAT)**	
		a. Inspect Return Air Sensor & connector	No physical damage to harness. No moisture, damaged or corroded pins 1MP Plug is connected tightly to microprocessor. No wires are pushed back through plug.
		b. Check Return Air Sensor resistance (See Note 4)	10,000 Ohms @ 77°F (25°C) [See section 2.12 for complete table of temperatures and resistance values.]
	2	**Check return air sensor wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
	3	**Check remote sensor/switch connector**	
		a. Locate and inspect 10–way connector for optional sensors and switches.	Connector must have cap on, No corrosion or moisture inside connector. If there is a problem with the connector and there are no remote sensors or switches in the unit, the connector may be removed and each individual wire separated from the others, terminated and insulated with heat shrink.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P154	**CHECK SUPPLY AIR SENSOR**		
	• TRIGGER–ON: Supply Air Sensor is not within the maximum range of –53°F to +158°F (–47°C to +70°C) • UNIT CONTROL: Pretrip will abort and "PRETRIP FAILED IN TEST 3" will be displayed in MessageCenter. Defrost termination will be as described in Section 4.4.8 • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Supply Air Temperature sensor (SAT)**	
		a. Inspect Supply Air Sensor & connector	No physical damage to harness. No moisture, damaged or corroded pins 1MP Plug is connected tightly to microprocessor. No wires are pushed back through plug.
		b. Check Supply Air Sensor resistance (See Note 4)	10,000 Ohms @ 77°F (25°C) [See section 2.12 for complete table of temperatures and resistance values.]
	2	**Check supply air sensor wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
	3	**Check remote sensor/switch connector**	
		a. Locate and inspect 10–way connector for optional sensors and switches.	Connector must have cap on, No corrosion or moisture inside connector. If there is a problem with the connector and there are no remote sensors or switches in the unit, the connector may be removed and each individual wire separated from the others, terminated and insulated with heat shrink.
	4	**Check remote sensor/switch connector**	
		a. Locate and inspect 10–way connector for optional sensors and switches.	Connector must have cap on, No corrosion or moisture inside connector. If there is a problem with the connector and there are no remote sensors or switches in the unit, the connector may be removed and each individual wire separated from the others, terminated and insulated with heat shrink.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P155	**CHECK COOLANT TEMP SENSOR**		
	• TRIGGER–ON: Engine Coolant Temp Sensor is not within the maximum range of –58°F to +266°F (–50°C to +130°C) • UNIT CONTROL: Pretrip will abort and "PRETRIP FAILED IN TEST 3" will be displayed in MessageCenter. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Engine Coolant Temperature sensor (ENCT)**	
		a. Inspect Engine Coolant Sensor & connector	No damage to sensor No moisture, damage or corrosion in connector 1MP Plug is connected tightly to microprocessor. No wires are pushed back through plug.
		b. Check Engine Coolant Sensor resistance (See Note 4)	10,000 Ohms @ 77°F (25°C) [See section 2.12 for complete table of temperatures and resistance values.]
	2	**Check engine coolant sensor wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
	3	**Check remote sensor/switch connector**	
		a. Locate and inspect 10–way connector for optional sensors and switches.	Connector must have cap on, No corrosion or moisture inside connector. If there is a problem with the connector and there are no remote sensors or switches in the unit, the connector may be removed and each individual wire separated from the others, terminated and insulated with heat shrink.
P156	**CHECK BATTERY VOLTS**		
	• TRIGGER–ON: Battery voltage is less than 11 VDC or greater than 17 VDC • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for battery voltage too high alarm**	
		a. Check for alarm 15	Alarm conditions must be corrected and the alarm cleared to continue.
	2	**Check for battery voltage too low alarm**	
		a. Check for alarm A16	Alarm conditions must be corrected and the alarm cleared to continue.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P157	**CHECK BATTERY CURRENT**		
	• TRIGGER–ON: With all circuits off, current flow of more than +1.5 or –2 Amps is detected in the electrical circuits. NOTE: If this alarm occurs, Pretrip Test #2 will not be performed. You will need to run Pretrip again. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check battery current draw.**	
		a. Note amp draw on display. (See Note 3)	Must show +1.5 to –2 Amps
	2	**Check individual circuits**	
		a. Isolate individual circuits and test amp draw	Must be in range. (Refer to Section 2.12)
	3	**Check For parasitic loads (electrical current being used by a non–refrigeration unit component)**	
		a. Check for electrical loads that are drawing current with all circuits OFF.	Check for non–factory installed electrical devices such as lift gates, inside lights, satellite systems, etc). These must have zero amps during Pretrip.
P158	**CHECK AMBIENT AIR SENSOR**		
	• TRIGGER–ON: Ambient Air Sensor is not within the maximum range of –53°F to +158°F (–47°C to +70°C) • UNIT CONTROL: Pretrip will abort and “PRETRIP FAILED IN TEST 3” will be displayed in MessageCenter. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Ambient Air Temperature sensor (AAT)**	
		a. Inspect Ambient Air Sensor & connector	No damage to sensor No moisture, damage or corrosion in connector 1MP Plug is connected tightly to microprocessor. No wires are pushed back through plug.
		b. Check Ambient Air Sensor resistance (See Note 4)	10,000 Ohms @ 77°F (25°C) [See section 2.12 for complete table of temperatures and resistance values.]
	2	**Check ambient air sensor wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
	3	**Check remote sensor/switch connector**	
		a. Locate and inspect 10–way connector for optional sensors and switches.	Connector must have cap on, No corrosion or moisture inside connector. If there is a problem with the connector and there are no remote sensors or switches in the unit, the connector may be removed and each individual wire separated from the others, terminated and insulated with heat shrink.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P160	**CHECK DISCH TEMP SENSOR**		
	• TRIGGER–ON: Compressor Discharge Temp Sensor is not within the maximum range of –40°F to +392°F (–40°C to +200°C) • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Compressor Discharge Temperature sensor (CDT)**	
		a. Inspect Compressor Discharge Temp Sensor & connector	No damage to sensor No damage or corrosion in connector 1MP Plug is connected tightly to microprocessor. No wires are pushed back through plug.
		b.Check Compressor Discharge Temp Sensor resistance (See Note 4)	100,000 Ohms @ 77°F (25°C) [See section 2.12 for complete table of temperatures and resistance values.]
	2	**Check compressor discharge temp sensor wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins
	3	**Check remote sensor/switch connector**	
		a. Locate and inspect 10–way connector for optional sensors and switches.	Connector must have cap on, No corrosion or moisture inside connector. If there is a problem with the connector and there are no remote sensors or switches in the unit, the connector may be removed and each individual wire separated from the others, terminated and insulated with heat shrink.
P162	**CHECK AUTO FRESH AIR EXCHANGE SOLENOID (AFAS) CIRCUIT**		
	• TRIGGER–ON: Normal Amps for the AFAX Circuit is 0.4 to 2.5 Amps. The circuit tests outside this range. • UNIT CONTROL: Alarm Only. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for bad F10 fuse**	
		a. Check circuit current	All conditions must be corrected in circuit
	2	**Check Auto Fresh Air Exchange Solenoid (AFAS)**	
		a. Check amp draw of AFAS	Use Component Test Mode (Section 5.2.2) to test. Refer to Section 2.12 for amp values. View current draw in the Unit Data List.
	3	**Check AFAS and circuit**	
		a. Inspect AFAS and wiring	No physical damage to harness. No damaged or corroded pins. No damage to solenoid
		b. Check operation of AutoFresh Air Exchange Relay (AFAR)	AFAS turned on and LED12 on. AFAR energized.
		c. Check voltage to AFAS	12VDC between AFAS B (ground) and AFAS A (+12VDC) when AFAR is energized.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P164	**CHECK UL2 CIRCUIT** • TRIGGER–ON: Normal Amps for the UL2 (Rear) Unloader Circuit is 0.75 to 2.0 Amps. The circuit tests outside this range. • UNIT CONTROL: Pretrip will abort and "PRETRIP FAILED IN TEST 3" will be displayed in MessageCenter. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for bad F4 or F6 fuse alarm**	
		a. Check for alarm 72	Alarm conditions must be corrected and the alarm cleared to continue.
	2	**Check UL2**	
		a. Check resistance of UL2	Refer to Section 2.12
		b. Check amp draw of UL2	Use Component Test mode (Section 5.2.2) to test. Refer to Section 2.12 for amp values. View current draw in the Unit Data list. (Refer to Section 3.13
	3	Check UL2 & circuit	
		a. Inspect UL2 and wiring	No damage or corrosion Connector fits together tightly, no moisture inside
		b. Check operation of UL2 FET (22)	START/RUN-OFF switch in START/RUN-Manual Start Operation. (See Note 4) LED must be ON
		c. Check voltage to UL2	Must be 11 VDC or higher across the 2 wires
	4	**Check UL2 circuit wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P165	**CANNOT PUMP DOWN** • TRIGGER–ON: With SV1, SV2, & SV4 in the closed position, the compressor is not able to pull the low side of the refrigerant system down to 10 PSIG (0.68 Bar). • UNIT CONTROL: Pretrip will abort and "PRETRIP FAILED IN TEST 11, 12 or 13" will be displayed in MessageCenter. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Visually inspect unit**	
		a. Is compressor turning with engine?	Compressor must turn with engine.
	2	**Check system pressure**	
		a. Check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading ± 5 PSIG (±0.34 Bar) on gauges & on micro display.
	3	**Manually test refrigeration system (See note 10)**	
		a. See Refrigeration Troubleshooting, Section 9.3 – "System Will Not Pump Down"	Must pass all tests Correct any problems found before proceeding.
		b. Run Quick Check	Correct any problems found before proceeding.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P174	**CHECK LOW SPEED RPM**		
	• TRIGGER–ON in Test #7: With Speed Relay turned off (speed solenoid de-energized), engine RPM are NOT Between 1375 and 1600 for **Ultima XTC and X2 2500A/R**; or Between 1275 and 1500 for **Ultra XTC and X2 2100A/R** • TRIGGER–ON in Test #9: 15 seconds after the High Speed Test, engine RPM have NOT dropped from the high speed RPM (in Test #8) by: Between 450 and 925 for **Ultima XTC and X2 2500A/R**; or Between 150 and 525 for **Ultra XTC and X2 2100A/R** • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check speed solenoid& linkage on non-Electronic Speed Controlled (ESC) engines and the Fuel and speed actuator on ESC engines**	
		a.Check speed solenoid (FSA on ESC) plunger	Must move in and out freely
		b. Check engine speed arm & linkage	Must move freely
	2	**Force low speed operation (See note 10)**	
		a. Set Functional Parameter "LOW SPEED START" for a high number (30 to 90) then start the unit. **Set Functional Parameter back to original setting after completing repairs.**	LED 27 must be OFF
		b. Check operation of Speed Relay LED	LED 27 must be OFF
		c. Check voltage to speed solenoid (FSA on ESC)	Must be 0 VDC
		d. On X2 2500 units ONLY, check for voltage on engine speed control unit (ENSCU) pin 22.	Must be 12 VDC
	3	**Check for proper voltage to the Engine Speed Control Unit (ENSCU) pin 16 based on requested speed from the micro.**	
		a. Check voltage at pin 16 with unit running.	Must be 0 VDC for all units
	4	**Check engine RPM**	
		a. Check actual engine RPM using hand held tachometer	Refer to Section 2.6 Adjust engine linkage setting as needed.
		b. Compare actual RPM with those shown on display.	Both readings within ± 50 RPM
	5	**Check engine air-intake system**	
		a. Check air filter indicator	Flag must not be visible.
		b. Inspect air intake system	Hoses & tubes in good condition. No kinks or restrictions
	6	**Check engine exhaust system**	
		a. Inspect the exhaust system	Must be clear and unobstructed

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P175	**CHECK HIGH SPEED RPM**		
	• TRIGGER–ON: With Speed Relay turned on (voltage at the speed solenoid / Engine Speed Control Unit for high speed operation (?)), engine RPM are NOT Between 2000 and 2300 for **Ultima XTC/X2 2500A/R**; or Between 1700 and 2000 for **Ultra XTC/X2 2100A/R** • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check speed solenoid & linkage on non-Electronic Speed Controlled (ESC) engines, or thefuel and speed actuator on ESCengines**	
		a. Check speed solenoid (FSA on ESC) plunger	Must move in and out freely
		b. Check engine speed arm & linkage	Must move freely
	2	**Force high speed operation (See note10)**	
		a. Set Functional Parameter “LOW SPEED START” to zero and adjust setpoint at least 10°F (5.6°C) above or below box temperature then start the unit. **Set Functional Parameter back to original setting after completing repairs.**	LED 27 must be ON
		b. Check operation of Speed Relay	LED 27 must be ON
		c. Check voltage to speed solenoid (FSA on ESC)	Must be 12–14 VDC
		d. Check resistance of speed solenoid (FSA on ESC)	Refer to Section 2.12
		e. Check amp draw of speed solenoid (FSA on ESC)	Use Component Test Mode (Section 5.2.2) to test. Refer to Section 2.12 for amp values. View current draw in the Unit Data list. (Refer to Section 3.13
		f. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins or terminals
		g. On X2 2500 units ONLY, check for voltage on engine speed control unit (ENSCU) pin 22.	Must be 12 VDC
	3	**Check for proper voltage to the Engine Speed Control Unit (ENSCU) pin 16 based on requested speed from the micro.**	
		a. Check voltage at pin 16 with unit running.	Must be 0 VDC for all units
	4	**Check engine RPM**	
		a. Check actual engine RPM using hand held tachometer	Refer to Section 2.6 Adjust engine linkage setting as needed.
		b. Compare actual RPM with those shown on display	Both readings within ± 50 RPM

P175 CHECK HIGH SPEED RPM (Continued)			
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	5	**Check engine air-intake system**	
		a. Check air filter indicator	Flag must not be visible.
		c. Inspect air intake system	Hoses & tubes in good condition. No kinks or restrictions
	6	**Check engine exhaust system**	
		a. Inspect the exhaust system	Must be clear and unobstructed

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P178	**CHECK UL1**		
	• TRIGGER–ON: The pressure differential between suction and discharge pressures did not change as expected when the UL1 (Front) Unloader was loaded (de-energized) or unloaded (energized) • UNIT CONTROL: If alarm A191 is already on, then Pretrip will be aborted & display will read “PRETRIP FAILED IN TEST 6”. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check wiring to DPT & SPT**	
		a. Verify that correct wires are connected to each transducer	Plugs to transducers are the same. The correct wire plug must be connected to the proper transducer.
	2	**Check system pressures**	
		a. Check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading – ± 5 PSIG (±0.34 Bar) – on gauges & on micro display.
	3	**Check for Check SV2 Circuit Alarm**	
		a. Check for alarm 97 or P192	Alarm conditions must be corrected and the alarm cleared to continue
	4	**Check for Check UL1 alarm**	
		a. Check for alarm 85 or P144	Alarm conditions must be corrected and the alarm cleared to continue
	5	**Check UL1 operation Unit must be running. (See Note 10) (See Section 8.15 – Unloader Checkout Procedure)**	
		a. Energize UL1 coil	Pressures must change within 3–4 seconds of coil being energized or de–energized Suction pressure must raise slightly Discharge pressure must drop slightly
		b. De-energize UL1 coil	Suction pressure must drop slightly Discharge pressure must raise slightly
	6	**Check for Check UL2 Unloader alarm**	
		a. Check for alarm P191	Alarm conditions must be corrected and the alarm cleared to continue
	7	**Check SV1 for being closed.**	
		a. Check voltage to SV1 coil.	Must be 0 VDC
		b. Check pressure differential between compressor discharge port and receiver king valve.	Must be less than 25 PSIG (1.70 Bars).
	8	**Check the compressor center head snubber tee**	
		a. Check snubber (restrictor) inside the tee assembly for HPS and CDP sensors	Tee must be open and not blocked or overly restricted. If in doubt, remove the snubber restrictor with a hammer and small punch, then restart pretrip.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P180	**CHECK SUCTION MODULATION VALVE** • TRIGGER–ON: Suction pressure did not drop as expected during Test 10 in Pretrip, when the CSMV was changing position. • UNIT CONTROL: Alarm only. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check connector to the suction modulation valve**	
		a. Inspect CSMV and wiring.	No damage or corrosion. Connector fits together tightly. No moisture inside.
	2	**Check operation of suction modulation valve**	
		a. See CSMV troubleshooting, Section 8.24.1	Must pass all tests.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P181	**CHECK SV4 VALVE** • TRIGGER–ON: Suction pressure did not rise within range & discharge pressure did not drop within range when SV4 was energized (opened) • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for SV4 alarm**	
		a. Check for alarms 79, P150	Alarm conditions must be corrected and the alarm cleared to continue
	2	**Check system pressures**	
		a. Check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading – ± 5 PSIG (±0.34 Bar) – on gauges & on micro display.
	3	**Check SV4 operation Unit must be running in Heat Cycle. (See Note 10) (See Section 8.23.1, Checking SV4)**	
		a. Set unit to run in high speed cool	After 60 seconds note suction and discharge pressures.
		b. Energize SV4 coil	Hot gas hissing sound will begin immediately. Suction pressure must rise slightly Discharge pressure must drop slightly
		c. De-energize SV4 coil	Hot gas hissing sound will stop immediately. Suction pressure must drop slightly Discharge pressure must rise slightly
	4	**Manually test refrigeration system**	
		a. Run Quick Check	Must pass all tests Correct any problems found before proceeding.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P182	**CHECK SV1 VALVE**		
	• TRIGGER–ON: Discharge pressure did not decrease when SV1 was de-energized (opened) as expected in Heat Pretrip Mode, or discharge pressure did not increase as expected when SV1 was energized (closed) in Cool Pretrip Mode. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for SV1 Alarm**	
		a. Check for alarms 80, P148	Alarm conditions must be corrected and the alarm cleared to continue
	2	**Check system pressures**	
		a. Check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading – ± 5 PSIG (±0.34 Bar) – on gauges & on micro display.
	3	**Check SV1 operation. Unit must be running in Heat Cycle. (See Note 10) (See Section 8.23.2 - Checking SV1)**	
		a. Set unit to operate in high speed heat	After 3 minutes note discharge and suction pressures
		b. De-energize SV1 coil	Compressor discharge pressure will drop Receiver tank pressure will raise slightly
	4	**Manually test refrigeration system**	
		a. Run Quick Check	Must pass all tests Correct any problems found before proceeding.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P191	**CHECK UL2** • TRIGGER–ON: The pressure differential between discharge and suction pressures did not change as expected when the UL2 (Rear) Unloader was loaded (de-energized) or unloaded (energized) • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for "Check SV2 Circuit Alarm"**	
		a. Check for alarm 97 or P192	Alarm conditions must be corrected and the alarm cleared to continue
	2	**Check for Check UL2 Unloader alarm**	
		a. Check for alarm 85 or P144	Alarm conditions must be corrected and the alarm cleared to continue
	3	**Check system pressures**	
		a. Check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading – ± 5 PSIG (±0.34 Bar) – on gauges & on micro display.
	4	**Check UL2 operation Unit must be running. (See Note 10) (See Section 8.15 – Checking Unloaders)**	
		a. Energize UL2 coil	Pressures must change within 3–4 seconds of coil being energized or de–energized Suction pressure must raise slightly Discharge pressure must drop slightly Check snubber
		b. De-energize UL2 coil	Suction pressure must drop slightly Discharge pressure must raise slightly
	5	**Check the compressor center head snubber tee**	
		a. Check snubber (restrictor) inside the tee assembly for HPS and CDP sensors	Tee must be open and not blocked or overly restricted. If in doubt, remove the snubber restrictor with a hammer and small punch, then restart pretrip.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P192	**CHECK SV2 CIRCUIT** • TRIGGER–ON: Normal Amps for the SV2 Circuit is 0.75 to 2.0 Amps. The circuit tests outside this range. • UNIT CONTROL: Pretrip will abort and “PRETRIP FAILED IN TEST 2” will be displayed in MessageCenter. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for bad F4 or F6 fuse alarm**	
		a. Check for alarm 72	Alarm conditions must be corrected and the alarm cleared to continue.
	2	**Check SV2**	
		a. Check resistance of SV–2	Refer to Section 2.12
		b. Check amp draw of SV2.	Use Component Test mode (Section 5.2.2) to test. Refer to Section 2.12 for amp values. View current draw in the Unit Data list. (Refer to Section 3.13
	3	**Check SV2 & circuit**	
		a. Inspect SV2 and wiring	No damage or corrosion Connector fits together tightly, no moisture inside
		b. Check operation of SV2 FET (21)	START/RUN-OFF switch in START/RUN-Manual Start Operation. (See Note 4) LED must be ON
		c. Check voltage to SV2	Must be 11 VDC or higher across the 2 wires
	4	**Check SV2 circuit wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P194	**HIGH SUCTION PRESSURE** • TRIGGER–ON: This alarm is generated during Test 4 of Cool Pretrip. Suction pressure is higher than normal. (Maximum suction pressure should be approximate MOP of TXV or a little bit higher during this test. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for check SV4 alarm**	
		a. Check for alarm P181	Condition must be corrected and alarm cleared to proceed.
	2	**Check system pressures**	
		a. Check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading – ± 5 PSIG (±0.34 Bar) – on gauges & on micro display.
	3	**Check MOP of expansion valve.**	
		a. Test MOP of Expansion valve.	Refer to Section 2.10
		b. Verify that correct TXV is in unit.	Must have correct valve.
	4	**Manually test refrigeration system (See note 10)**	
		a. Run Quick Check	Must pass all tests Correct any problems found before proceeding.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P195	**LOW SUCTION PRESSURE**		
	• TRIGGER–ON: This alarm is generated during Test 4 of Cool Pretrip. Suction pressure is lower than normal, using the lesser value of the two following calculations. Minimum suction pressure should be 15 PSIG (1Bar) less than TXV MOP (see section 2.10 for MOP values); OR RAT minus 40°F (22°C) (Calculate suction pressure using a Temperature–Pressure chart See Table 8-8). For example, if the RAT is +45°F, you would take 45°F minus 40°F which equals 5°F. Look up the saturated suction pressure for 5°F. See Table 8-8. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check wiring to DPT & SPT**	
		a. Verify that correct wires are connected to each transducer	Plugs to transducers are the same. The correct wire plug must be connected to the proper transducer.
	2	**Check fan belts**	
		a. Check upper fan belt tension & condition	(Refer to Section 8.7 for belt tensions) No Glazing, no cracking, no slipping
		b. Check lower fan belt tension & condition.	(Refer to Section 8.7 for belt tensions) No Glazing, no cracking, no slipping
	3	**Check evaporator air flow (See note 10)**	
		a. Check evap fan clutch	Must be engaged
		b. Check evaporator section, return air bulkhead, air chute, cleanliness of evap. coil	Good Air Flow Return air not restricted Air chute in good condition No damage to blower wheel Evap. coil clean
	4	**Check for Check SV2 Circuit Alarm**	
		a. Check for alarm 97 or P192	Alarm conditions must be corrected and the alarm cleared to continue
	5	**Check system pressures**	
		a. Check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading – ± 5 PSIG (±0.34 Bar) – on gauges & on micro display.
	6	**Check refrigerant charge**	
		a. Check for undercharged system. (See Section 8.12.1 – Checking Refrigerant Charge)	Level must be above lower sight glass
	7	**Manually defrost unit**	
		a. Defrost unit and terminate automatically.	Typical defrost cycle time is 5–20 minutes Suction pressure should rise gradually during cycle.
	8	**Check system pressures**	
		a. Check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading – ± 5 PSIG (±0.34 Bar) – on gauges & on micro display.
		Additional steps on the next page.	

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P195 LOW SUCTION PRESSURE (Continued)			
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	9	**Manually test refrigeration system (See note 10)**	
		a. Run Quick Check	Must pass all tests. Correct any problems found before proceeding
		b. See Refrigeration Troubleshooting, Section 9.3.7– "Low Suction Pressure."	
	10	**Check expansion valve (TXV)**	
		a. Visually inspect valve	Bulb must be clamped tightly on the suction line and insulated
		b. Check MOP of valve	Refer to Section 2.10
		c. Check superheat of valve	Refer to Section 2.10
	11	**Check for damage to the suction line.**	
		a. Visually inspect suction line for any kinks, restrictions, or other damage.	No damage to line
	12	**Check for restricted compressor suction screen.**	
		a. Visually inspect compressor suction inlet screen for material.	Must be clean and unobstructed.
	13	**Check expansion valve (TXV)**	
		a. Visually inspect valve	Bulb must be clamped tightly on the suction line and insulated
		b. Check MOP of valve	Refer to Section 2.10
		c. Verify that correct TXV is in unit.	Must have correct valve.
		d. Check superheat of valve	Refer to Section 2.10
	14	**Check for damage to the suction line.**	
		a. Visually inspect suction line for any kinks, restrictions, or other damage.	No damage to line
	15	**Check for restricted compressor suction screen.**	
		a. Visually inspect compressor suction inlet screen for material.	Must be clean and unobstructed.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P196	**HIGH DISCHARGE PRESSURE**		
	• TRIGGER–ON: This alarm is generated during Test 4 of Cool Pretrip. Discharge pressure is higher than normal. *('Normal" discharge pressure for systems operating in the Cool Mode can be estimated by taking the temperature of the air entering the condenser coil (Ambient Air Temperature AAT) and adding 30°F (16.6° C) to it, then looking at a pressure temperature chart-see Table 8-8- for the corresponding pressure.)* • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check fan belts**	
		a. Check upper fan belt tension & condition	(Refer to Section 8.7 for belt tensions) No Glazing, no cracking, no slipping
		b. Check lower fan belt tension & condition.	(Refer to Section 8.7 for belt tensions) No Glazing, no cracking, no slipping
	2	**Check wiring**	
		a. Visually Inspect wiring to SV4 & both Compressor Unloaders	Wires must be connected properly & securely to each component
	3	**Check airflow through condenser coil (See note 10)**	
		a. Inspect condenser / radiator fins	Fins must be straight. 90% or more of the coil surface must be undamaged. No “dead” air spaces. Condenser / Radiator coil must be clean.
		b. Check airflow (with unit running).	Even airflow through the entire coil No “dead” spots
	4	**Check system pressures**	
		a. Install Manifold Test Set and check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction & Discharge Pressures must have the same reading on gauges & on micro display. Pressures must be in the normal range for ambient & box temperature conditions.
	5	**Check for refrigerant overcharge**	
		a. Check refrigerant level in the receiver tank.	Level must be between upper & lower sight glasses
	6	**Check discharge check valve**	
		a. Check that discharge check valve opens fully	Must open fully with unit running
		b. Check discharge check valve screen	Must be clean of any debris
	7	**Manually test refrigeration system (See note 10)**	
		a. Run Quick Check	Must pass all tests Correct any problems found before proceeding.
	8	**Check system for non–condensable**	
		a. Check refrigeration system for non–condensable gas(es)	No non–condensable gas(es) may be present.
		b. See Refrigeration Troubleshooting, Section 9.3.7 - “High Discharge Pressure.”	
	9	**Check Compressor**	
		a. Remove all Compressor heads and inspect valve plates, unloaders, reed valves, & gaskets	Must be in good condition. No broken or missing parts.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P198	**LOW DISCHARGE PRESSURE**		
	• TRIGGER–ON: In the Heat Pretrip mode, the Compressor Discharge Pressure did not rise to normal. *(The minimum 'Normal" discharge pressure for systems operating in the Heat Pretrip Mode can be estimated by taking the temperature of the air entering the condenser coil (Ambient Air Temperature AAT) and looking at a pressure temperature chart-see table Table 8-8-for the corresponding pressure, then adding 80 psig (5.5bars) to it.)* • UNIT CONTROL: Pretrip will abort and "PRETRIP FAILED IN TEST 4" will be displayed in MessageCenter. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check for ambient sensor alarm**	
		a. Check for alarm(s) 121 and P158	Alarm conditions must be corrected and the alarm cleared to continue.
		b. Check Ambient Sensor calibration	Must be within ±10°F (±5.5°C) of actual temperature
	2	**Check system pressures**	
		a. Install Manifold Test Set and check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction pressure must be above 3 PSIG (0.2 Bar) Suction & Discharge Pressures must have the same reading on gauges & on micro display.
	3	**Check refrigerant charge**	
		a. Check for undercharged system	Level must be above lower sight glass
	4	**Check SV1 operation. (See Section 8.23.2 - Checking SV1)**	
		a. Check the operation of the SV1 valve per test procedure	Must perform correctly Correct any problems found before proceeding
	5	**Check compressor for ability to pump up pressure**	
		a. Check the operation of the high side of the compressor by covering the condenser inlet air.	Discharge pressure must rise a minimum of 50 to 100 psig (3.4 to 6.9 bars)
		a. Remove compressor heads & inspect condition of all reeds & gaskets	Must be in good condition.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P200	**CHECK UL1 CYLINDERS** • TRIGGER–ON: A problem has been detected inside the front cylinder head of the compressor with a suction reed, discharge reed, head gasket or valve plate gasket. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check refrigerant charge**	
		a. Check for undercharged system	Level must be above lower sight glass
	2	**Manually test refrigeration system (See note 10)**	
		a. Run Quick Check	Must pass all tests Correct any problems found before proceeding.
		b. Check and compare compressor suction pressure with pressure shown on the microprocessor controller.	Suction Pressure must have the same reading on gauge & on micro display.
	3	**Check compressor front head reed valves & gaskets**	
		a. Remove compressor front head & inspect condition of all reeds & gaskets	Must be in good condition.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P201	**CHECK UL2 CYLINDERS** • TRIGGER–ON: A problem has been detected inside the rear cylinder head of the compressor with a suction reed, discharge reed, head gasket or valve plate gasket. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found.* Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Manually test refrigeration system (See note 10)**	
		a. Run Quick Check	Must pass all tests Correct any problems found before proceeding.
		b. Check and compare compressor suction pressure with pressure shown on the microprocessor controller.	Suction Pressure must have the same reading on gauge & on micro display.
	2	**Check compressor rear head reed valves & gaskets**	
		a. Remove compressor rear head & inspect condition of all reeds & gaskets	Must be in good condition.
P202	**HIGH SIDE LEAK** • TRIGGER–ON: With the Low Pressure Side of the refrigeration system forced to low pressure, refrigerant pressure is leaking past one of the components in the High Pressure Side of the refrigeration system into the Low Pressure Side.. • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Manually test refrigeration system (See note10)**	
		a. Run Quick Check	Must pass all tests Correct any problems found before proceeding.
		b. Check and compare compressor suction pressure with pressure shown on the microprocessor controller.	Suction Pressure must have the same reading on gauge & on micro display.
		c. With manifold gauges connected to the compressor discharge and suction valves, and the unit running in Cool, slowly front seat the King Valve until the suction pressure reaches 5 psig (3 bar), then shut the engine off.	Monitor manifold gauges with the unit off. The suction and discharge pressures should not equalize for several minutes. Correct any problems before proceeding.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P203	**CHK DISCHARGE CHECK VALVE** • TRIGGER–ON: Refrigerant is leaking backwards through the Discharge Check Valve • UNIT CONTROL: Alarm Only • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check discharge check valve**	
		a. Test Discharge Check Valve for leakage	Must not leak.
	2	**Manually test refrigeration system (See note 10)**	
		a. Run Quick Check	Must pass all tests Correct any problems found before proceeding.
		b. Check and compare compressor suction pressure with pressure shown on the microprocessor controller.	Suction Pressure must have the same reading on gauge & on micro display.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P204	**LOW SUCTION PRESSURE**		
	• TRIGGER–ON: Suction Pressure is less than –10inHg (–0.34 Bar) for more than 30 continuous seconds, or less than 16inHg (–0.54 Bar) for more than 5 seconds at any time during Pretrip. • UNIT CONTROL: Pretrip will abort and "PRETRIP FAILED IN TEST X" will be displayed in MessageCenter indicating in which test the suction pressure was too low. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check fan belts**	
		a. Check upper fan belt tension & condition	(Refer to Section 8.7 for belt tensions) No Glazing, no cracking, no slipping
		b. Check lower fan belt tension & condition.	(Refer to Section 8.7 for belt tensions) No Glazing, no cracking, no slipping
	2	**Check system pressures**	
		a. Install Manifold Test Set and check and compare compressor discharge & suction pressures with those shown on the microprocessor controller.	Suction pressure must be above 3 PSIG (0.2 Bar) Suction & Discharge Pressures must have the same reading on gauges & on micro display.
	3	**Manually defrost unit**	
		a. Defrost unit and terminate automatically.	Typical defrost cycle time is 5–20 minutes Suction pressure should rise gradually during cycle.
	4	**Check evaporator air flow**	
		a. Check evap fan clutch	Must be engaged
		b. Check evaporator section, return air bulkhead, air chute, cleanliness of evap. coil	Good Air Flow Return air not restricted Air chute in good condition No damage to blower wheel Evap. coil clean
	5	**Check refrigerant charge – See Section 8.12.1 – Checking Refrigerant Charge)**	
		a. Check for undercharged system	Level must be above lower sight glass
	6	**Check expansion valve (TXV)**	
		a. Visually inspect valve	Bulb must be clamped tightly on the suction line and insulated
		b. Check MOP of valve	Refer to Section 2.10
		c. Check superheat of valve	Refer to Section 2.10

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
P205	**CHK DEFROST TERM 2 SENSOR** • TRIGGER–ON: Defrost Termination Temperature Sensor 2 is not within the maximum range of –53°F to +158°F (–47°C to +70°C) • UNIT CONTROL: Alarm and defrost cycle will terminate as described in section 4.4.8. • RESET CONDITION: Auto Reset if Pretrip mode is started again, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check Defrost Termination Temperature sensor 2 (DTT2)**	
		a. Inspect Defrost Termination Temperature Sensor 2 & connector	No damage to sensor No damage or corrosion in connector 1MP plug is connected tightly to microprocessor. No wires are pushed back through plug.
		b. Check Defrost Termination Temperature Sensor 2 resistance (See Note 4)	10,000 Ohms @ 77°F (25°C) [See section 2.12 for complete table of temperatures and resistance values.]
	2	**Check defrost termination temperature sensor 2 wiring**	
		a. Inspect harness & control box connector pins & terminals (See wiring schematic)	No physical damage to harness. No damaged or corroded pins

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
7.10 MAINTENANCE ALARMS			
223	**ENGINE MAINTENANCE DUE** • TRIGGER–ON: The Engine Maintenance Hour Meter time has expired. • UNIT CONTROL: Alarm Only. Alarm Light will NOT be turned on. • RESET CONDITION: Alarm may be manually reset via keypad.		
	1	**Check unit maintenance records**	
		a. Schedule unit into service facility for maintenance	Must be done soon!
	2	**Perform maintenance**	
		a. Perform appropriate engine & unit maintenance	Follow instructions on proper maintenance form
	3	**Reset engine maintenance hour meter**	
		a. Check that the Engine Maintenance Hour Meter interval is set for your requirements.	Reset Interval in Configuration list as required.
		b. Reset Engine Maintenance Hour Meter for the next service interval	Hour Meter is reset in the Functional Parameter list. Follow maintenance interval recommendations in Section 8.1.
	4	**See Note 1**	
		a. Clear the inactive alarms.	All alarms cleared.
225	**GENERAL MAINTENANCE DUE** • TRIGGER–ON: The General Maintenance Hour Meter time has expired. • UNIT CONTROL: Alarm Only. Alarm Light will NOT be turned on. • RESET CONDITION: Alarm may be manually reset via keypad.		
	1	**Check unit maintenance records**	
		a. Schedule unit into service facility for maintenance	Must be done soon!
	2	**Perform maintenance**	
		a. Perform appropriate engine & unit maintenance	Follow instructions on proper maintenance form
	3	**Reset general maintenance hour meter**	
		a. Check that the General Maintenance Hour Meter interval is set for your requirements.	Reset Interval in Configuration list as required.
		b. Reset General Maintenance Hour Meter for the next service interval	Hour Meter is reset in the Functional Parameter list. Follow maintenance interval recommendations in Section 8.1.
	4	**See Note 1**	
		a. Clear the inactive alarms.	All alarms cleared.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
226	**SERVICE SOON – PM #1 DUE** • TRIGGER–ON: The Maintenance Hour Meter #1 time has expired. • UNIT CONTROL: Alarm Only. Alarm Light will NOT be turned on. • RESET CONDITION: Alarm may be manually reset via keypad.		
	1	**Check unit maintenance records**	
		a. Schedule unit into service facility for maintenance	Must be done soon!
	2	**Perform maintenance**	
		a. Perform appropriate engine & unit maintenance	Follow instructions on proper maintenance form
	3	**Reset maintenance hour meter #1**	
		a. Check that Maintenance Hour Meter #1 interval is set for your requirements.	Reset Interval in Configuration list as required.
		b. Reset Maintenance Hour Meter #1 for the next service interval	Hour Meter is reset in the Functional Parameter list. Follow maintenance interval recommendations in Section 8.1.
	4	**See Note 1**	
		a. Clear the inactive alarms.	All alarms cleared
227	**SERVICE SOON – PM #2 DUE** • TRIGGER–ON: The Maintenance Hour Meter #2 time has expired. • UNIT CONTROL: Alarm Only. Alarm Light will NOT be turned on. • RESET CONDITION: Alarm may be manually reset via keypad.		
	1	**Check unit maintenance records**	
		a. Schedule unit into service facility for maintenance	Must be done soon!
	2	**Perform maintenance**	
		a. Perform appropriate engine & unit maintenance	Follow instructions on proper maintenance form
	3	**Reset maintenance hour meter #2**	
		a. Check that Maintenance Hour Meter #2 interval is set for your requirements.	Reset Interval in Configuration list as required.
		b. Reset Maintenance Hour Meter #2 for the next service interval	Hour Meter is reset in the Functional Parameter list. Follow maintenance interval recommendations in Section 8.1.
	4	**See Note 1**	
		a. Clear the inactive alarms.	All alarms cleared.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
228	**SERVICE SOON – PM #3 DUE** • TRIGGER–ON: The Maintenance Hour Meter #3 time has expired. • UNIT CONTROL: Alarm Only. Alarm Light will NOT be turned on. • RESET CONDITION: Alarm may be manually reset via keypad.		
	1	**Check unit maintenance records**	
		a. Schedule unit into service facility for maintenance	Must be done soon!
	2	**Perform maintenance**	
		a. Perform appropriate engine & unit maintenance	Follow instructions on proper maintenance form
	3	**Reset maintenance hour meter #3**	
		a. Check that Maintenance Hour Meter #3 interval is set for your requirements.	Reset Interval in Configuration list as required.
		b. Reset Maintenance Hour Meter #3 for the next service interval	Hour Meter is reset in the Functional Parameter list. Follow maintenance interval recommendations in Section 8.1.
	4	**See Note 1**	
		a. Clear the inactive alarms.	All alarms cleared
229	**SERVICE SOON – PM #4 DUE** • TRIGGER–ON: The Maintenance Hour Meter #4 time has expired. • UNIT CONTROL: Alarm Only. Alarm Light will NOT be turned on. • RESET CONDITION: Alarm may be manually reset via keypad.		
	1	**Check unit maintenance records**	
		a. Schedule unit into service facility for maintenance	Must be done soon!
	2	**Perform maintenance**	
		a. Perform appropriate engine & unit maintenance	Follow instructions on proper maintenance form
	3	**Reset maintenance hour meter #4**	
		a. Check that Maintenance Hour Meter #4 interval is set for your requirements.	Reset Interval in Configuration list as required.
		b. Reset Maintenance Hour Meter #4 for the next service interval	Hour Meter is reset in the Functional Parameter list. Follow maintenance interval recommendations in Section 8.1.
	4	**See Note 1**	
		a. Clear the inactive alarms.	All alarms cleared.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
230	**SERVICE SOON – PM #5 DUE** • TRIGGER–ON: The Maintenance Hour Meter #5 time has expired. • UNIT CONTROL: Alarm Only. Alarm Light will NOT be turned on. • RESET CONDITION: Alarm may be manually reset via keypad.		
	1	**Check unit maintenance records**	
		a. Schedule unit into service facility for maintenance	Must be done soon!
	2	**Perform maintenance**	
		a. Perform appropriate engine & unit maintenance	Follow instructions on proper maintenance form
	3	**Reset maintenance hour meter #5**	
		a. Check that Maintenance Hour Meter #5 interval is set for your requirements.	Reset Interval in Configuration list as required.
		b. Reset Maintenance Hour Meter #5 for the next service interval	Hour Meter is reset in the Functional Parameter list. Follow maintenance interval recommendations in Section 8.1.
	4	**See Note 1**	
		a. Clear the inactive alarms.	All alarms cleared.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
7.11 MICROPROCESSOR ALARMS			
232	**SETPOINT ERROR** • TRIGGER–ON: There is an error in the Setpoint that is stored in the microprocessor memory, or in the memory sector of the microprocessor that the Setpoint is stored in. • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Reset when a valid Setpoint is entered, or Alarm may be manually reset by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check setpoint**	
		a. Check Setpoint setting	Must be between –30°C to +32°C (–22°F to +89.6°F)
		b. Enter new Setpoint	Must be between –30°C to +32°C (–22°F to +89.6°F)
	2	**Reset microprocessor**	
		a. Turn the Start/Run–Off switch off for 30 seconds and then turn back on.	The microprocessor powers up OK and the latest setpoint appears in the display.
		b. Valid Setpoint can not be entered.	Replace microprocessor
	3	**See Note 1**	
		a. Clear the inactive alarms.	All alarms cleared
233	**MODEL # ERROR** • TRIGGER–ON: There is an error in the Model Number that is stored in the microprocessor memory, or in the memory sector of the microprocessor that the Model Number is stored in. • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Reset only when a valid Model number is entered.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check model number**	
		a. Check Model Number in microprocessor	Must be a valid Model Number from Configuration List.
		b. Enter correct Model Number	From Configuration List, select correct Model Number.
	2	**Reset microprocessor**	
		a. Turn Start/Run–Off switch off for 30 seconds, then turn back on.	Microprocessor powers up OK
		b. Check for valid Model number in Data List.	Valid number is present. Alarm is cleared
		c. Valid model number can not be entered.	Replace microprocessor
	3	**See Note 1**	
		a. Clear the inactive alarms.	All alarms cleared

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
237	**FUNCTIONAL PARAMETERS ERROR** • TRIGGER–ON: There is an error in one or more of the Functional Parameters that are stored in the microprocessor memory, , or in the memory sector of the microprocessor that the Functional Parameters are stored in. • UNIT CONTROL: Unit Shutdown & Alarm. • RESET CONDITION: Auto Reset when valid Functional Parameters are entered, or Alarm may be manually reset by turning the unit off, then back on again		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check functional parameters**	
		a. Check Functional Parameters	All must be set for selectable values
	2	**Reset microprocessor**	
		a. Turn Start/Run–Off switch off for 30 seconds, then turn back on.	Microprocessor powers up OK
		b. Check for valid Functional Parameters in Functional Parameters List.	Valid number is present. Alarm is cleared
		c. Valid Functional Parameter(s) can not be entered.	Replace microprocessor
	3	**See Note 1**	
		a. Clear the inactive alarms.	All alarms cleared.
238	**CONFIGURATIONS 1 ERROR** • TRIGGER–ON: There is an error in Configuration Group 1 that is stored in the microprocessor memory, or in the memory sector of the microprocessor that the Configurations are stored in. • UNIT CONTROL: Unit Shutdown & Alarm. • RESET CONDITION: Auto Reset when valid Configuration(s) are entered, or Alarm may be manually reset by turning the unit off, then back on again		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check configurations**	
		a. Check Configurations	All must be set for selectable values
		b. Install new configurations using ReeferManager via serial connection or Configuration PC Card.	Verify that the current version of ReeferManager is being used (check for the latest version information on the Information Center web site).
		c. Verify that the most recent version of microprocessor software is installed in the controller.	Check for the latest version of Advance Microprocessor software on the Information Center web site. Install the latest version if necessary.
	2	**Reset microprocessor**	
		a. Turn Start/Run–Off switch off for 30 seconds, then turn back on.	Microprocessor powers up OK
		b. Check for valid Configurations in Data List.	Valid number is present. Alarm is cleared
		c. Valid Configurations can not be entered.	Replace microprocessor
	3	**See Note 1**	
		a. Clear the inactive alarm.	All alarms cleared.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
242	**DIS PRESS CALIBRATE ERROR** • TRIGGER–ON: There is an error in the Discharge Pressure Sensor Calibration value stored inthe microprocessor memory or in the memory sector of the microprocessor that the calibration value is stored in. • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Reset when the Discharge Pressure Sensor is calibrated successfully, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check discharge pressure reading**	
		a. Check Discharge Pressure Reading	Must read valid data.
	2	**Calibrate discharge pressure sensor**	
		a. Calibrate Discharge Pressure Sensor.	Calibration successful.
		b. Discharge Pressure Sensor can not be successfully calibrated.	Replace microprocessor
	3	**See Note 1**	
		a. Clear the inactive alarms.	All alarms cleared.
243	**SUCT/EVAP CALIBRATE ERROR** • TRIGGER–ON: There is an error in the Suction / Evaporator Pressure Sensor Calibration value stored in the microprocessor memory or in the memory sector of the microprocessor that the calibration value is stored in. • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Reset when the Suction / Evaporator Pressure Sensor is calibrated successfully, or Alarm may be manually reset via Keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, the active alarm should clear itself (see reset condition above). Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check suction / evaporator pressure reading**	
		a. Check Suction / Evaporator Pressure Reading	Must read valid data.
	2	**Calibrate suction / evaporator pressure sensor**	
		a. Calibrate Suction / Evaporator Pressure Sensor.	Calibration successful.
		b. Suction / Evaporator Pressure Sensor can not be successfully calibrated.	Replace microprocessor
	3	**See Note 1**	
		a. Clear the inactive alarms.	All alarms cleared.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
246	**EEPROM WRITE FAILURE** • TRIGGER-ON: There is an error in the ability to write information to be stored in the memory • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Alarm may be manually reset via keypad or by turning the unit off, then back on again.		
NOTE: Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check microprocessor**	
		a. Check Setpoint setting	Must be between -22°F to +89.6°F (-30°C to +32°C)
		b. Enter new Setpoint	Must be between -22°F to +89.6°F (-30°C to +32°C)
	2	**Reset microprocessor**	
		a. Turn START/RUN-OFF switch off for 30 seconds, then turn back on.	Microprocessor powers up OK
		b. Alarm 246 remains active.	Replace microprocessor.
	3	**See Note 1**	
		a. Clear the inactive alarms.	All alarms cleared.
248	**CONF MODE / HP2 ERROR** • TRIGGER–ON: Microprocessor internal operational program error. • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Reset only when valid info is available for the microprocessor are entered.		
Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check microprocessor**	
		a. Check Setpoint setting	Must be between -22°F to +89.6°F (-30°C to +32°C)
		b. Enter new Setpoint c. Check Functional Parameters	Must be between -22°F to +89.6°F (-30°C to +32°C) All settings must be valid.
	2	**Reset microprocessor**	
		a. Turn START/RUN-OFF switch off for 30 seconds, then turn back on.	Microprocessor powers up OK
		b. Alarm 248 remains active.	Replace microprocessor.
	3	**See Note 1**	
		a. Clear the inactive alarms.	All alarms cleared.

Alarm NO.	Steps	ALARM / CAUSE	CORRECTIVE ACTION
249	**MICROPROCESSOR ERROR** • TRIGGER–ON: Microprocessor Input Conversion Error • UNIT CONTROL: Unit Shutdown & Alarm • RESET CONDITION: Auto Reset when input conversions are valid, or Alarm may be manually reset by turning the unit off, then back on again.		
Follow the steps below until a problem is found. Once a repair or correction has been made, clear the alarm(s). (See Note 1) Operate the unit through the appropriate modes to see if any active alarm occurs. Continue with the steps below as necessary.			
	1	**Check microprocessor**	
		a. Check Temperature Sensor Data	Must be valid reading for RAT, SAT, AAT, etc.
		b. Check for any Active Sensor Alarms	Must all be cleared.
	2	**Check microprocessor & unit Wiring**	
		a. Check Wiring to Micro and at input devices to the micro.	Must not be miss wired to allow 12 VDC on any of the sensor input circuits.
	3	**Reset microprocesso**r	
		a. Turn START/RUN-OFF switch off for 30 seconds, then turn back on.	Microprocessor powers up OK
		a. Alarm 249 remains active.	Replace microprocessor.
	4	**See Note 1**	
		a. Clear the inactive alarms.	All alarms cleared

SECTION 8

SERVICE

⚠ WARNING

Beware of V-belts and belt driven components as the unit may start automatically. Before servicing unit, make sure the START/RUN-OFF switch is in the OFF position or the unit is in Maintenance mode. Also disconnect the negative battery cable.

⚠ WARNING

UNITS EQUIPPED WITH STAR-TRAK TWO WAY COMMUNICATION CAPABILITIES MAY HAVE THE ABILITY TO BE STARTED OR TURNED OFF REMOTELY REGARDLESS OF THE SETTING OF THE START/RUN-OFF SWITCH.

The unit is controlled locally and there can be no two-way communication when the mode switch on the Remote Monitoring control box is in MAINTENANCE MODE. Therefore, when performing any work on the unit, place the mode switch in MAINTENANCE MODE. After the unit is serviced, return the mode switch to REMOTE ON. (Refer to Section 3.19.3 for more information on two-way communication.)

⚠ CAUTION

Unit uses R404A and POE oil. The use of inert gas brazing procedures is mandatory for all Carrier Transicold refrigeration units; otherwise compressor failure will occur. For more information, refer to Technical Procedure 98-50553-00 Inert Gas Brazing

⚠ CAUTION

When changing oil filters, the new filters should be primed (partially filled) with clean oil if possible. If the filters are not primed, the engine may operate for a period with no oil supplied to the bearings.

NOTE

To avoid damage to the earth's ozone layer, use a refrigerant recovery system whenever removing refrigerant. When working with refrigerants you must comply with all local government environmental laws, U.S.A. EPA section 608.

8.1 MAINTENANCE SCHEDULE

For the most reliable operation and for maximum life, your unit requires regular maintenance. This includes oil and filter changes, fuel and air filter replacement, coolant replacement, and pretrip inspections. Maintenance should be performed according to the schedule on the following page.

Table 8-1. Maintenance Schedule

SYSTEM	OPERATION	ACTION/- REFERENCE SECTION
a. Daily Maintenance		
	Pre-Trip Inspection - before starting	3.3
	Check Engine Hours	Check
	Check Engine Oil Level	Check
b. Every Service Interval[1] or Annually		
Unit	1. Check unit mounting bolts	Check
	2. Check engine and compressor mount bolts	Check
	3. Check door latches & hinges	Check
	4. Check gauges, switches and electrical connections	Check
	5. Check all belt tensions[1]	8.7
	6. Check control box	Check
	7. Check gearbox and fan shaft for oil leaks	Check
	8. Check fan shaft, idler and gearbox bearings	Check
	9. Check clutch air gap and adjust as required	Check
Engine	1. Check oil/filter change interval[1] (refer to section **f.** of this table)	8.6.3
	2. Check for oil leaks	Check
	3. Check low oil pressure safety	2.11
	4. Clean crankcase breather	8.6.7
	5. Check engine speeds for units without electronic speed control	Table 2-1
Fuel System	1. Clean fuel pump strainer	8.4
	2. Change fuel filter(s)[1] (refer to section **f.** of this table)	8.4
	3. Check fuel heater (optional)	---
Cooling System	1. Clean radiator/condenser fin surface	8.6.1 and 8.28
	2. Check antifreeze concentration[1]	8.6.1
	3. Check water pump	Check
	4. Check water temperature sensor functions	2.6
Exhaust System	1. Check mounting hardware	Check
	2. Check muffler and exhaust pipes	Check
Air Intake System	1. Change air cleaner element[1]	Check
	2. Check and replace air filter indicator if needed	8.6.6
Starting System	1. Check battery condition	Check/Replace
	2. Clean battery connections and cable ends	Check/Replace
	3. Check battery hold down clamps	Check
	4. Check starter operation	Check
Charging System	1. Check alternator brushes and replace if necessary	Check
	2. Check alternator output	2.12

SYSTEM	OPERATION	ACTION/-REFERENCE SECTION
b. Every Service Interval[1] or Annually (Continued)		
Refrigeration System	1. Check air switch & calibrate	4.15
	2. Check & clean evaporator coil and defrost drain hoses	8.27
	3. Check operating refrigerant pressure	Check
	4. Check all sensor calibrations	Check
	5. Check manual defrost operation	Check
	6. Check Compressor drive coupling	Check
	7. Perform Pre–Trip inspection	8.2
c. Every 6000 Hour Maintenance (Normal Operating Conditions) with conventional coolant		
Cooling System	1. Drain and flush cooling system **(12,000 hours with Extended Life Coolant)**	Section 8.6.1
d. Every 10,000 Hour Maintenance		
Perform complete 2000 and 3000 hour Preventive Maintenance and the following:		
Fuel System	1. Clean and adjust injector nozzles.	Engine Service Guide
e. Every 12,000 Hour Maintenance with extended life coolant		
Cooling System	1. Drain and flush cooling system **(6,000 hours with Conventional Coolant)**	Section 8.6.1

f. Oil And Filter Change Intervals		
	Oil & Filter Change Interval using API Class CG engine oil	**Oil & Filter Change Interval using Mobil Delvac 1 engine oil***
Standard Oil Filter	2000 hrs/1yr	4000 hrs/2 yrs**
ESI Oil Filter	3000 hrs/2 yrs	

* Mobil Delvac1 is the only approved synthetic oil. Maximum oil drain interval is two (2) years.
** New oil filter required at 1 yr interval

These maintenance schedules are based on the use of approved oils and regular pretrip inspections of the unit. Failure to follow the recommended maintenance schedule may affect the life and reliability of the refrigeration unit.

8.2 PRETRIP INSPECTION

The following pretrip inspection should be performed before every trip and at regular maintenance intervals.

BEFORE STARTING ENGINE
Drain water from bottom of fuel tank
Drain water from water separator on fuel filter (if applicable)
Check radiator coolant level
Check condenser coil for cleanliness
Check radiator coil for cleanliness
Check air filter and hoses
Check engine oil level
Check condition and tension of belts
Check all fan and idler bearings
Check door latches and hinges
Check condition of condenser fan blades
Check battery fluid level (if applicable)
Check battery cables and terminals
Check evaporator coil for cleanliness
Check air chute (if applicable)
Check bulkhead and return air screen
Check all defrost water drains
Place in Continuous Run, and start unit.
IMMEDIATELY AFTER STARTING ENGINE
Check fuel lines and filters for leaks
Check oil lines and filters for leaks
Check coolant hoses for leaks
Check exhaust system for leaks
Check condenser fan for proper airflow.
Check evaporator fan for proper airflow.
Ensure clutch engages properly – no slip or unusual noises
Check for unusual noises – alternator, fan shaft, water pump, idler and gearbox, bearings, etc.

PRETRIP
Initiate Pretrip
List any Pretrip Alarms
AFTER OPERATING UNIT FOR 15 MINUTES OR MORE
Check refrigerant level
Check compressor oil level
Check for proper temperature control
Check engine speeds
Check auto-start/stop operation
Initiate defrost and allow to terminate
Check engine speeds
OPERATE IN HIGH SPEED COOL AND RECORD (From Microprocessor Unit Data List)
SUCTION PRESSURE . . . . .
DISCHARGE PRESSURE . . . . .
ENGINE COOLANT TEMP . . . . .
RETURN AIR TEMP . . . . .
SUPPLY AIR TEMP . . . . .
AMBIENT AIR TEMP . . . . .
DEFROST TERM TEMP #2 . . . . .
COMP DISCH TEMP . . . . .
CSMV % . . . . .
BATTERY VOLTAGE . . . . .
DC CURRENT DRAW . . . . .
ENGINE RPM . . . . .
SOFTWARE REVISION . . . . .
CONTROL SERIAL # . . . . .
UNIT MODEL # . . . . .
HOURS TO ENGINE MAINTENANCE . .
HOURS TO UNIT MAINTENANCE . . . . .
TIME LEFT TO PM1 . . . . .
TIME LEFT TO PM2 . . . . .
TIME LEFT TO PM3 . . . . .
TIME LEFT TO PM4 . . . . .
TIME LEFT TO PM5 . . . . .
DATALOGGER TIME & DATE . . . . .
FINAL
Review Functional Parameters
Download recorder data (if required)
Enter Trip Start in Micro

8.3 PRIMING FUEL SYSTEM

8.3.1 Mechanical Fuel Pump

The mechanical fuel lift pump is mounted on the engine next to the injection pump. This pump has a manual plunger for priming the fuel system when the fuel tank has been run dry. (See Figure 8–1).

To prime the fuel system, use the following steps:

a. Turn the bleed valve (red) counter-clockwise until fully opened.

b. Turn the top of the manual fuel pump plunger counter-clockwise to unlock it. **S-L-O-W-L-Y** (up/down once per second) pump the manual plunger until positive pressure (resistance) is felt. This may take up to 200 strokes. This will indicate fuel flow.

c. Continue to pump **S-L-O-W-L-Y** (up/down once per second) approximately 100 more strokes to fill the filter and bleed the air out of the lines.

d. Start engine. It may be necessary to continue to pump until the engine starts.

e. Depress and turn the top of the manual plunger clockwise to **lock in place.**

f. When engine is running smoothly, turn bleed valve clockwise until fully closed.

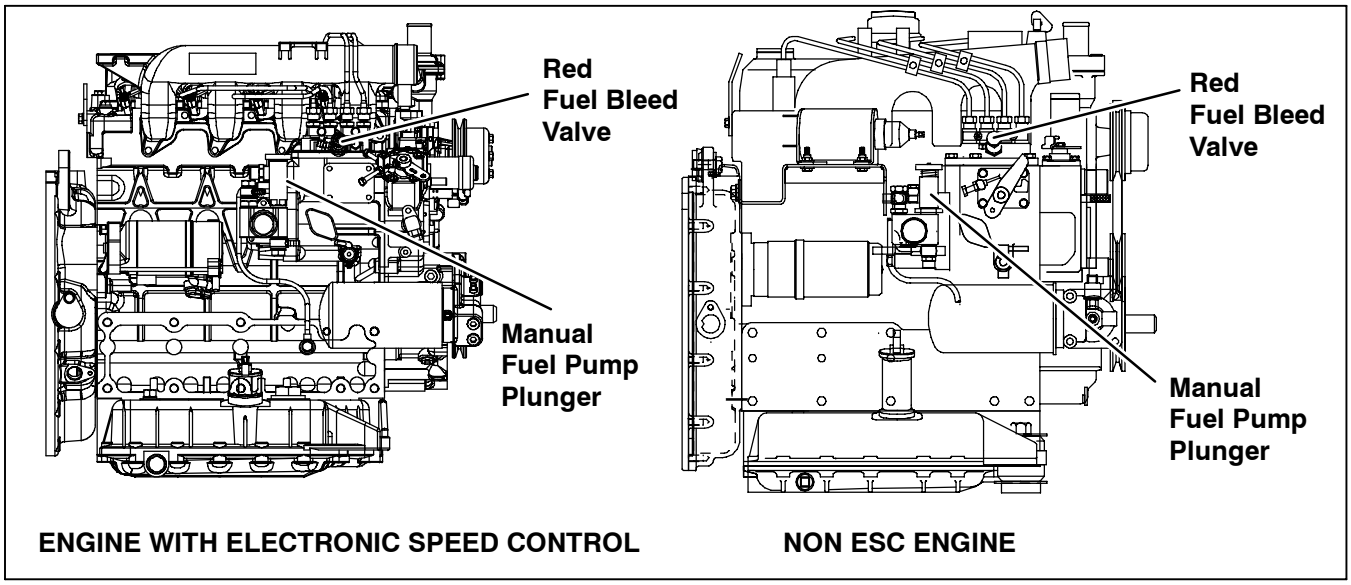
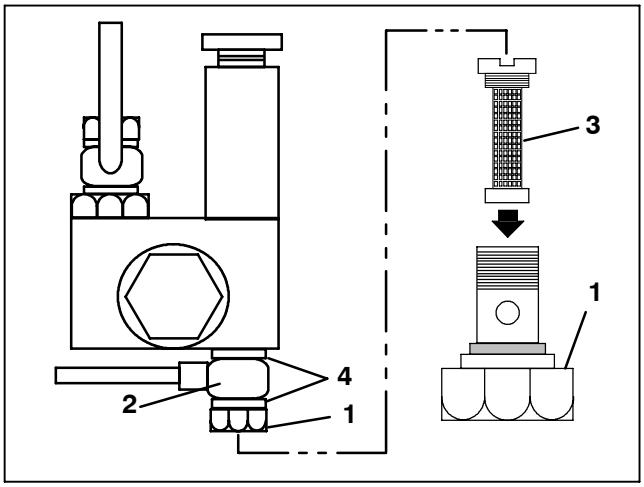


Figure 8–1. Priming Fuel Pump

8.4 SERVICING FUEL PUMP

8.4.1 Mechanical Pump (See Figure 8-2)

Due to foreign particles in the fuel and wax as a result of using the wrong grade of fuel or untreated fuel in cold weather, the fuel filter may become plugged or restricted and the engine will lose capacity. The filter must be cleaned on a regular schedule such as when the oil filter is changed (Refer to Section 8.1).



1. Nut
2. Banjo
3. Filter
4. Copper Rings

Figure 8-2. Mechanical Fuel Pump

a. Turn nut counter-clockwise to loosen and remove nut (item 1, Figure 8–2). Use container to catch draining fuel.

b. Remove banjo fitting (item 2) and let it hang loose.

c. Turn filter (item 3) counter-clockwise and remove. Check and clean.

d. Replace copper rings (item 4)

e. To install reverse steps 1 through 3.

8.5 FUEL LEVEL SENSOR

An optional fuel level sensor (p/n 12-00548-07 or new sensor 12-00548-06) supplies an input signal to the microprocessor as to the % of fuel remaining in the fuel tank. The microprocessor then turns on the Check Fuel Level alarm when the level reaches 15%, and (if configured to do so) turns the engine off when the level reaches 10%.

The sensor has the capability of sending from 0% to 100% of the fuel level to the microprocessor. The fuel tank level will be displayed in the Unit Data list. This sensor may be calibrated if necessary.

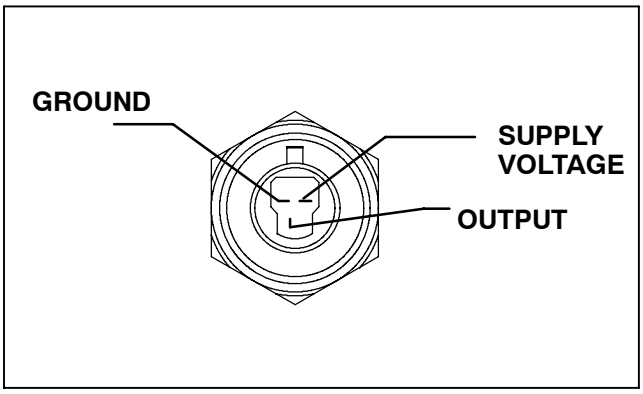


Figure 8-3. Fuel Level Sensor Wiring

8.5.1 Testing The 0 To 100% Fuel Level Sensor

a. Verify that the wiring to sensor is correct.

b. Check voltage at the Fuel Level Sensor with the START/RUN-OFF switch in the START/RUN position. (Unit running, or Unit off and Manual Start mode selected.)

c. Voltage between red wire (positive) and black wire (negative) should be 12.5 to 13.5 VDC. Do not disconnect the red or black wires from the switch.

d. Disconnect the white wire (output) from the sensor. Voltage between black wire (negative) and white wire (output) should be 0 VDC when the switch is dry and out of the fuel.

e. When the switch is immersed into fuel, the voltage reading between black wire (negative) and white wire (output) increase up to 5 VDC when fuel has reached the full mark.

8.6 ENGINE SERVICE AND COMPONENTS

8.6.1 Cooling System

Air flows through the condenser/radiator. The condenser/radiator must be internally and externally clean for adequate cooling. The water pump V-belt must be adjusted periodically to provide maximum air flow. (Refer to Section 8.7.2)

⚠ CAUTION

Use only ethylene glycol anti-freeze (with inhibitors) in system as glycol by itself will damage the cooling system. Always add pre-mixed 50/50 anti-freeze and water to radiator/engine. Never exceed more than a 60% concentration of anti-freeze. Use a low silicate anti-freeze meeting GM specifications GM 6038M for standard life coolant or use an extended life coolant , which is Dexcool approved and has 5/150 (5 years/150,000 miles) on the label.

Do the following to service the cooling system:

a. Remove all foreign material from the condenser/radiator coil. Compressed air or water may be used as a cleaning agent. It may be necessary to use warm water mixed with any good commercial dishwasher detergent. Rinse coil with fresh water if a detergent is used.

NOTE

Draining the coolant from the engine petcock will leave approximately 1 quart (.9 liters) of coolant in the block.

b. Drain coolant completely by removing lower radiator hose and radiator cap.

c. Install hose and fill system with clean, untreated water to which 3 - 5% of an alkaline based radiator cleaner is added – 6 oz (151 grams) to 1 gallon (3.78 liters) of water.

d. Run engine and drain while warm. Rinse system three times after it has cooled down. Refill system with water.

e. Run engine to operating temperature. Drain system again and fill with 50/50 water/anti-freeze mixture. Unit coolant capacity is 1.67 U.S. gallons. (see Caution Note and Refer to Section 2.6) NEVER POUR COLD WATER INTO A HOT ENGINE, however hot water can always be added to a cold engine.

8.6.2 Testing The RPM Sensor (Units beginning with below serial numbers and ALL X2 units Refer to Section 8.6.5 for information on units with Electronic Speed Control).

Serial Number Cut-Offs

- Ultra XTC – KAV90910396
- Ultima XTC – KAV90910334

a. Verify that the wiring to sensor is correct. See wiring schematic in Section 10.

b. Check voltage at the RPM Sensor connector with the Run Relay energized (Unit running, Unit off, Manual Start mode selected, and test must be completed within five minutes – before the Failed To Start Manual mode occurs, or Component Test mode will energize the Run Relay for five minutes without starting the unit.)

c. Voltage between ENRPMA-2MP31 and ENRPMC-2MP7 should be 5.0 VDC.

d. Check continuity between ENRPMB and 2MP18.

e. If the above tests check OK, read warning below. If the RPM display is still not correct, replace the RPM sensor.

⚠ WARNING

The +5.0 VDC (terminal B) is common between the compressor discharge pressure transducer, the compressor suction pressure transducer, and the RPM sensor. If this circuit is shorted to ground (due to one of the mentioned components being defective, or a frayed wire) the MessageCenter will show:

•Suction Pressure: 0 inHg/Bar
•Discharge Pressure: 0 Bar/PSIG
•Engine RPM: 0

8.6.3 Lube Oil Filters

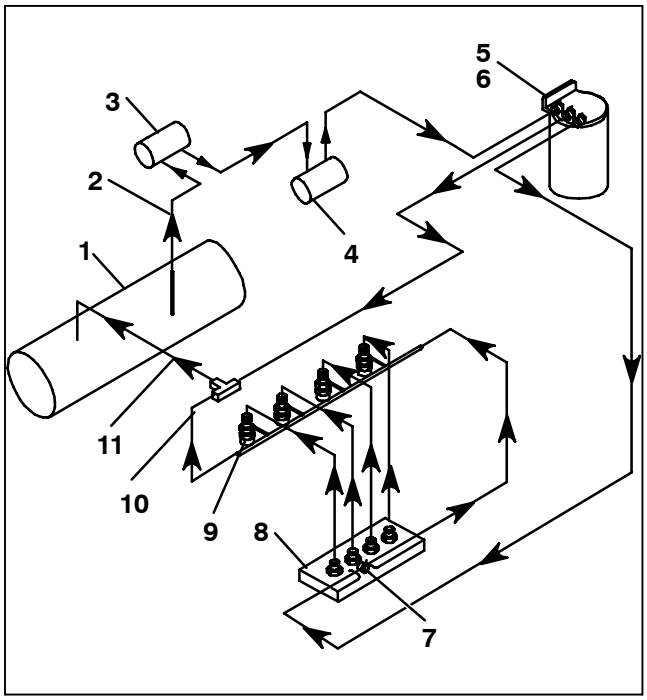
After warming up the engine, stop engine, place shallow drain pan under filter and remove filter. Lightly oil gasket on new filter before installing. Tighten per the filter manufacturer's directions.

⚠ CAUTION

When changing oil filters, the new filters should be primed (partially filled) with clean oil if possible. If the filters are not primed, the engine may operate for a period with no oil supplied to the bearings.

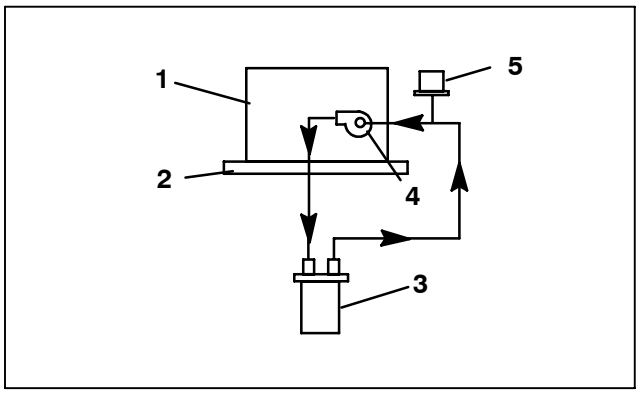
Replace filter(s) and add lube oil. (Refer to Section 2.6) Warm up engine and check for leaks.

Lube Oil And Fuel Flow Diagrams



1. Fuel Tank
2. Fuel Supply Line
3. Fuel Pump (Optional)
4. Mechanical Lift Pump
5. Fuel Filter
6. Fuel Warmer (Optional)
7. Fuel Bleed Valve
8. Injection Pump
9. Injector Nozzles
10. Fuel Leak-off Line
11. Fuel Return Line

Figure 8-4. Fuel System Diagram



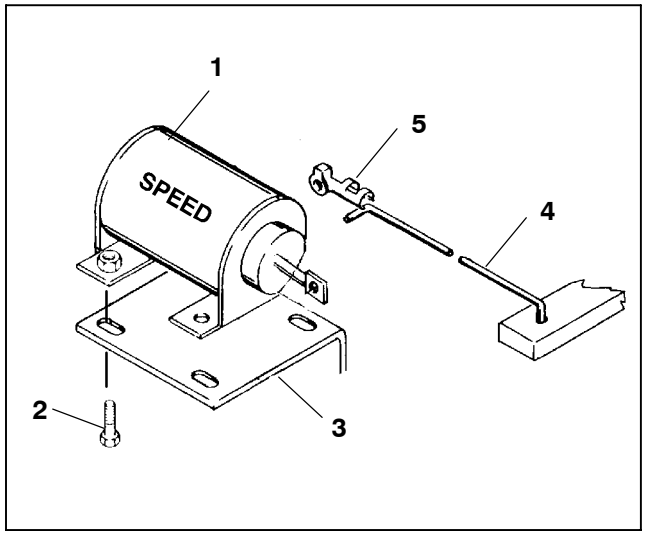
1. Engine Block
2. Oil Pan
3. Full Flow Oil Filter
4. Engine Oil Connection
5. Oil Pressure Switch

Figure 8-5. Lube Oil Flow Diagram

8.6.4 Servicing The Speed Control Solenoid And Linkage - Non ESC engines only (Units beginning with below serial numbers and ALL X2 units Refer to Section 8.6.5 for information on units with Electronic Speed Control).

Serial Number Cut-Offs

- Ultra XTC - KAV90910396
- Ultima XTC - KAV90910334



1. Solenoid
2. Bolt
3. Solenoid Bracket
4. Linkage (Speed)
5. Clip

Figure 8-6. Speed Control Solenoid

a. Solenoid Removal/Replacement

1. Disconnect wiring to solenoid. Disconnect linkage arm (Item 4, Figure 8-6) from solenoid. Remove mounting hardware from solenoid and then remove solenoid.

2. Install replacement solenoid and mounting hardware. Do not tighten at this time.

3. Attach linkage to solenoid and install the clip to the linkage rod.

b. Low Speed Adjustment

1. Hold the speed lever against the low speed stop and check the RPM. Adjust the low speed stop screw if necessary.

2. Check engine speed using microprocessor data list.

3. Check for proper operation by running Pretrip (Refer to Section 3.3).

c. High Speed Adjustment

1. Loosen but do not remove the 4-speed solenoid mounting nuts.

2. Turn the jacking nut, allowing the solenoid to move along the slots until the desired high speed is reached. Tighten the solenoid mounting bolts and verify correct high and low speed RPM.

3. Check for proper unit operation by running Pretrip (Refer to Section 3.3).

NOTE

LE (Low Emission) DI engines are delivered with a tamper resistant high-speed adjustment screw on the engine. High-speed adjustments are made using the slotted holes in the solenoid mounting bracket and the speed solenoid adjusting bracket with solenoid adjusting bolt and lockout (on the bracket).

8.6.5 Electronic Speed Control (ESC) (Units beginning with below serial numbers and ALL X2 units)

- Ultra XTC – KAV90910396
- Ultima XTC – KAV90910334

Refer to Section 10 for schematic wiring diagram. Refer to Section 9 for ESC diagnostic alarms and diagnostic trees.

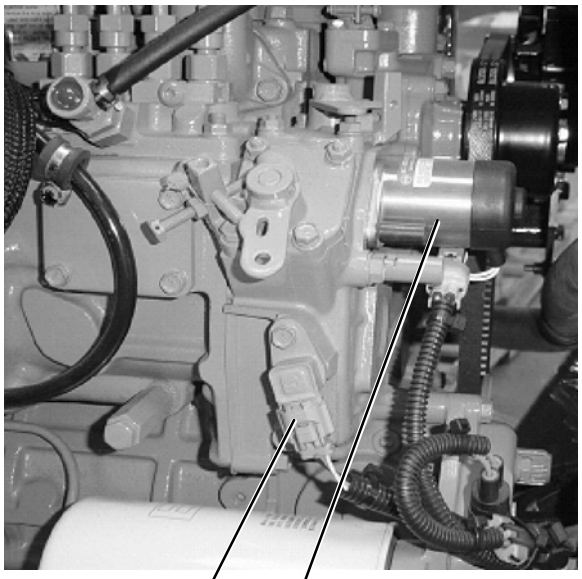


Figure 8-7. Electronic Speed Control Components

Engines with electronic speed control have no RPM sensor, speed or fuel solenoids. Engine speed is controlled by way of three components: the engine speed control unit (ENSCU), the fuel and speed actuator (FSA) and the engine speed sensor (ENSSN).

The ENSCU is mounted on the roadside frame behind the upper door. It provides the RPM signal to the microprocessor. The unit has an alarm LED incorporated within it, which is used to diagnose failures within the ESC system.

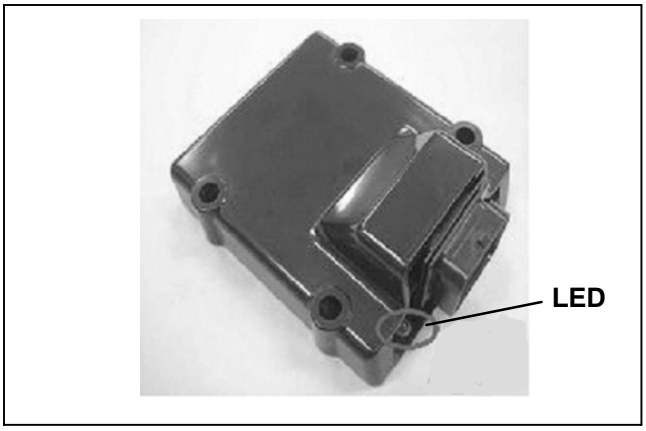


Figure 8-8. Frame Mounted Engine Speed Control Unit (ENSCU)

The FSA combines the fuel shutoff solenoid and speed control solenoid into one component. Engine speed is controlled by varying rod position.

The ENSSN provides the RPM signal to the ENSCU for speed control.

8.6.6 Engine Air Filter

a. Inspection

The dry type air filter should be inspected regularly for leaks. A damaged air filter or hose can seriously affect the performance and life of the engine. The air filter is designed to effectively remove contaminants from the air stream entering the engine. An excessive accumulation of these contaminants in the air filter will impair its operation; therefore, a service schedule should be set up and followed. The following simple service steps are easily made while the engine is being serviced in the field:

1. Check all connections for mechanical tightness. Be sure filter outlet pipe is not fractured.
2. In case of leakage and if adjustment does not correct the trouble, replace necessary parts or gaskets. *Swelled or distorted gaskets must always be replaced.*
3. Air Filter Service Indicator

The air filter indicator is connected to the engine air intake manifold and its function is to indicate when the air filter requires replacing. When a plugged air filter decreases intake manifold pressure to 20" (500 mm) Hg, the indicator moves to the red line. The air filter should be replaced and the indicator reset by pressing the reset button.

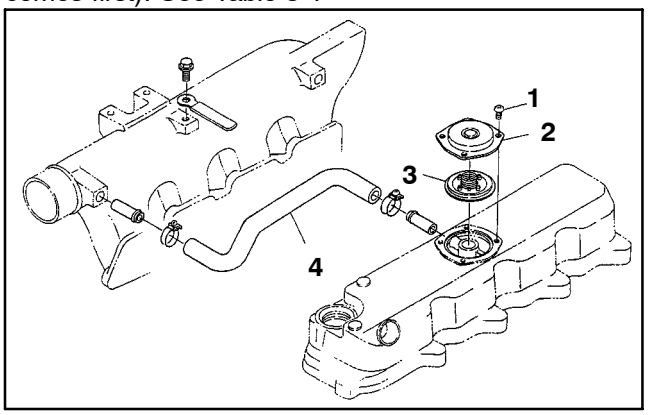
4. Service Procedure

Stop the engine, remove air filter. Install new air filter.

8.6.7 Engine Crankcase Breather

The engine uses a closed type breather with the breather line attached to the cylinder head cover. (See Figure 8-9)

The breather assembly should be cleaned once a year or at every 2000 hours maintenance interval (whichever comes first). See Table 8-1



1. Screw
2. Breather Cover
3. Breather Valve
4. Breather Tube

Figure 8-9. DI - Engine Crankcase Breather

8.6.8 Servicing Glow Plugs

The total circuit amp draw for the glow plug circuit is checked during a Pretrip cycle. The glow plugs, when energized, draw a nominal 6 to 9 amps each at 10.5 vdc. When servicing, the glow plug is to be fitted carefully into the cylinder head to prevent damage to glow plug. Torque value for the glow plug is 14 to 18 ft-lb (1.9 to 2.5 Mkg).

Checking for a Defective Glow Plug

a. The entire circuit may be tested using Component Test mode. (Refer to Section 5.2.2.)

b. To test individual glow plugs, disconnect all glow plugs from each other, and place an ammeter (or clip--on ammeter) in series with each glow plug and energize the plugs. Each plug (if good) should show 6 to 9 amps draw (at 12 VDC).

c. A second method is to disconnect the wire connection to the plug and test the resistance from the plug to a ground on the engine block. The reading should be 0.7 to 1.2 ohms if the plug is good.

8.7 SERVICING AND ADJUSTING V-BELTS

⚠ WARNING

Beware of V-belts and belt driven components as the unit may start automatically. Before servicing unit, make sure the START/RUN-OFF switch is in the OFF position or the unit is in Maintenance mode. Also disconnect the negative battery cable.

8.7.1 Belt Tension Gauge

Use a belt tension gauge (tester) P/N 07-00253, shown in Figure 8-10 whenever V-belts are adjusted or replaced.

A belt tension gauge provides an accurate and easy method of adjusting belts to their proper tension. Properly adjusted belts give long lasting and efficient service. Too much tension SHORTENS belt and bearing life, and too little tension causes slippage and excessive belt wear. It is also important to keep belts and sheaves free of any foreign material, which may cause the belts to slip.

The belt tension gauge can be used to adjust all belts. The readings, which we specify for Carrier Transicold units are applicable only for our belts and application, as the tension is dependent on the size of the belt and distance between sheaves. When using this gauge, it should be placed as close as possible to the midpoint between two sheaves. (See Figure 8-11)

The V-belts must be kept in good condition with the proper tension to provide adequate air movement across the coils.

Table 8-2. Belt Tension (See Figure 8-11)

BELTS	Tension	
	Lbs	Mkg
Water Pump/Alternator/Crankshaft	45 to 55	6.2 to 7.6
Gearbox to Fan shaft	70 to 80	9.7 to 11.1
Engine to Gearbox	70 to 80	9.7 to 11.1

Figure 8-10 Belt Tension Gauge (Part No. 07-00253)

8.7.2 Water Pump/Alternator/Crankshaft V-Belt

The water pump/alternator/crankshaft V-belt is driven by a sheave on the engine crankshaft. Frayed, cracked or worn belts must be replaced. Adjustment is achieved by altering the position of the front side idler/alternator.

When replacing a V-belt, avoid excessive force when applying tension to the V-belt to prevent damage to the water pump bearings. (Refer to Table 8-2)

a. Make sure negative battery terminal is disconnected and remove old belt.

b. Place V-belt on alternator sheave and then install alternator with two bolts loosely in position.

c. Check the center alignment of the engine drive, alternator and water pump sheaves to ensure proper alignment. Pulley misalignment will create excess belt wear and shorten alternator bearing life. The center line of all three sheaves must be in line.

d. Pivot alternator to place tension on belt using hand force only. *Do not use pry bar or excessive force as it may cause bearing failure.* For correct belt tension see Table 8-2. Tighten pivot and adjustment bolts.

e. Reinstall negative battery cable.

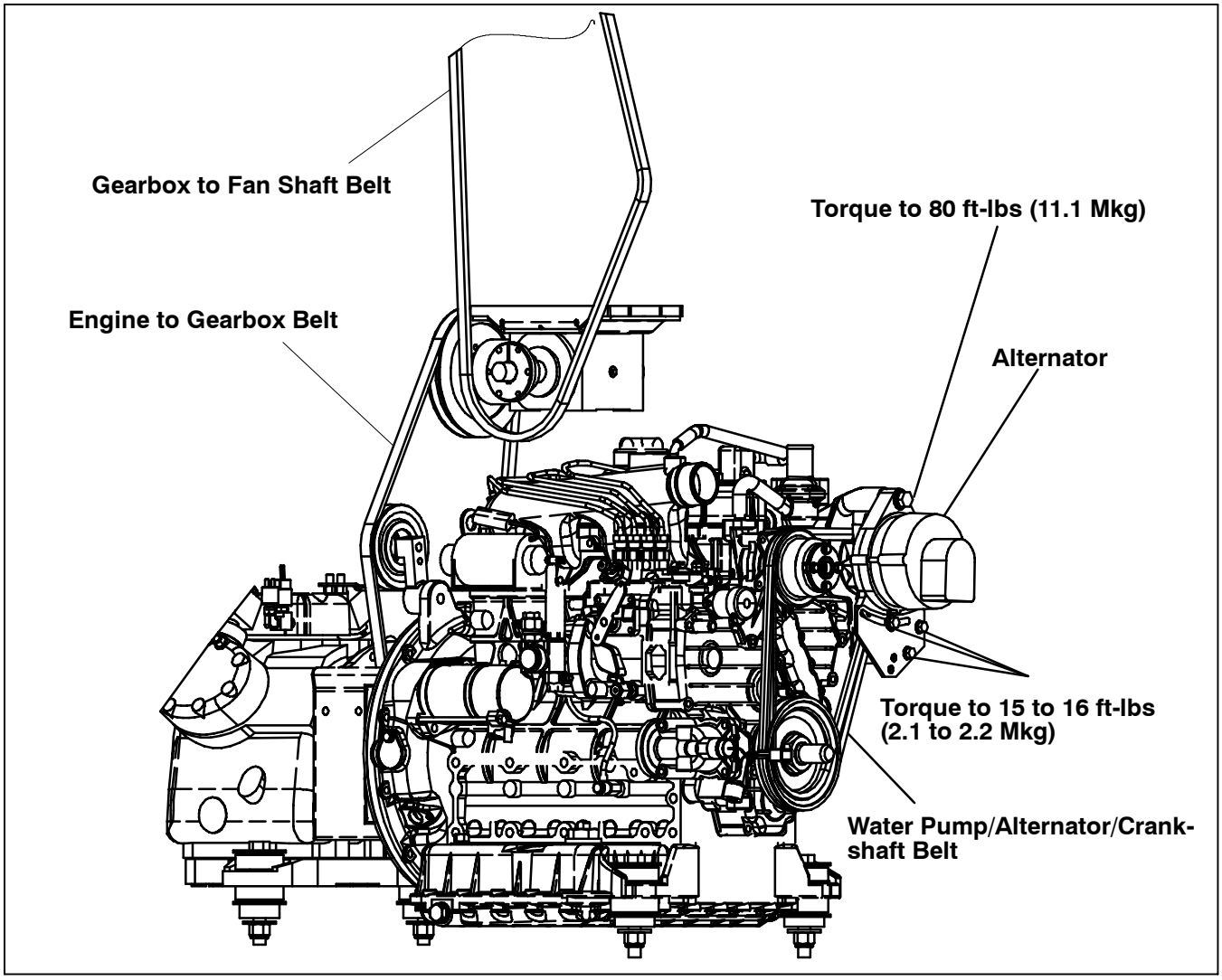


Figure 8-11. V-Belt Arrangement
Non ESC Engine

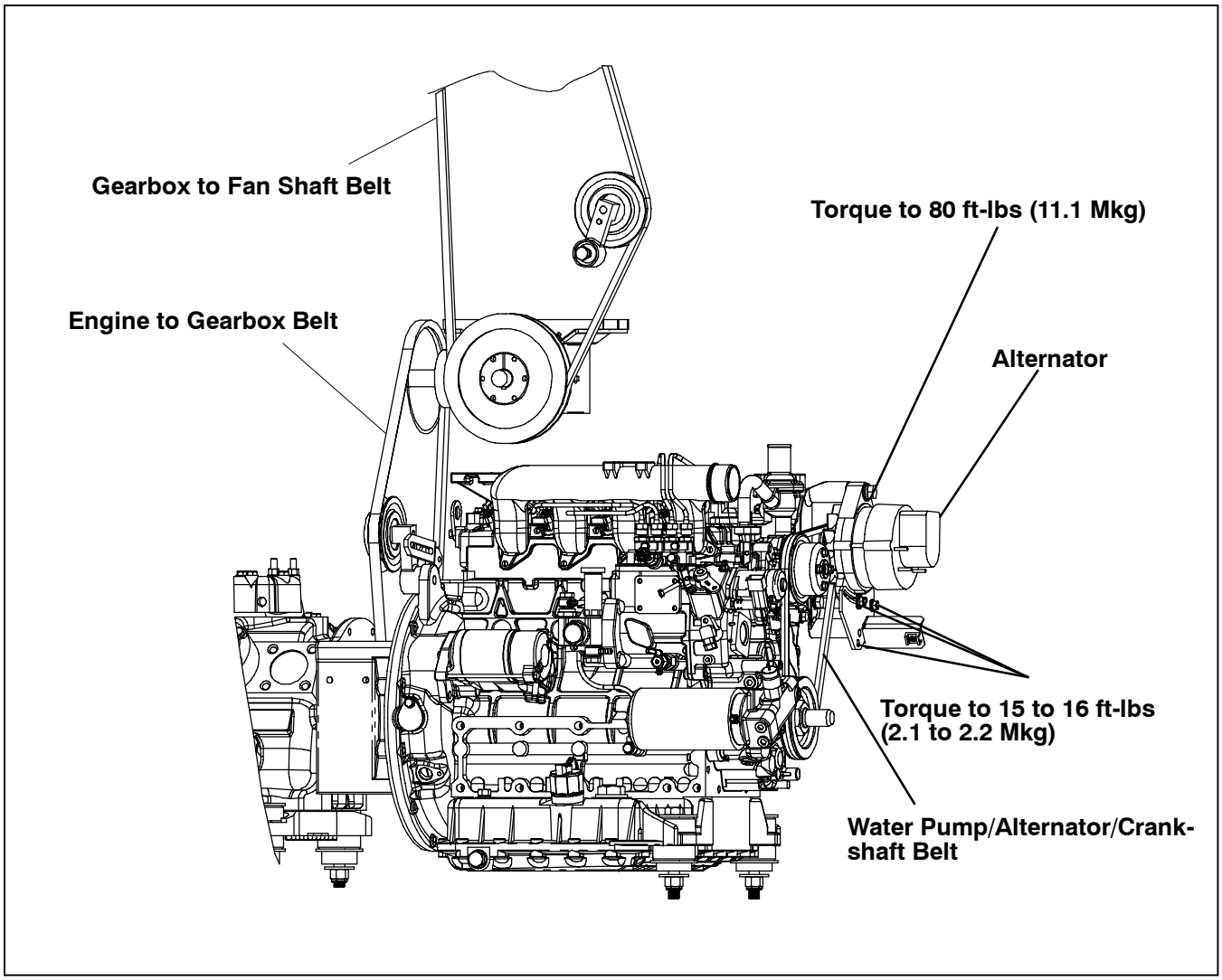


Figure 8–12. V-Belt Arrangement
Electronic Speed Control Engine

8.7.3 Gearbox To Fan Shaft And Engine To Gearbox V-Belt

a. Gearbox to Fan Shaft V-Belt

⚠ WARNING

Keep hands and arms away from unit when operating without belt guard in place. Never release a unit for service without the belt guard securely tightened in place

To Replace V-belt:

1. Disconnect negative battery cable and remove V--belt guard.
2. DO NOT START UNIT UNTIL V-BELT GUARD IS INSTALLED.

3.Loosen idler pulley.

4. Remove old belt and replace with new belt. (See Figure 8–11)
5. Using a belt tension gauge (Figure 8–10) on the belt, rotate idler pulley so that the gauge reads the correct tension (Refer to Table 8-2).
6. Tighten idler, carriage bolt, and bolts.

NOTE

The tension of both belts must be checked and adjusted, if necessary, after a brief break-in period. (See step 6)

7. Reconnect negative battery cable, and install belt guard and operate unit in high speed for 5-10 minutes. Remove guard and disconnect battery. Repeat steps 4 and 5.

b. Engine To Gearbox V-Belt

1. Disconnect negative battery cable and remove V--belt guard, and then loosen idler bolt.
2. Match mark adapter to engine flywheel (See Figure 8–13A) for ease of assembly.
3. Remove six bolts (5/16-18 x 1 lg), securing adapter drive sheave to engine flywheel, Figure 8–13A.
4. Insert two of the six bolts (5/16-18 x 1 lg) into the threaded holes (jacking holes) provided on engine adapter. Jack adapter from engine flywheel. Remove the two screws from adapter. Insert a pry bar between engine flywheel and adapter, Figure 8–13A and slide the adapter-sheave toward the compressor enough to change the V-belt as shown in Figure 8–13B. Replace V-belt.
5. Pry the adapter back toward the engine flywheel or use 5/16-18 x 2-1/2 lg bolts (3) in every other hole of adapter and take up evenly on the bolts until the 5/16-18 x 1 lg bolts engage engine flywheel. Apply thread sealer (Loctite #262) to the bolts used to secure adapter to flywheel. Take up on all bolts evenly and then torque to a value of 28 ft-lb (3.87 Mkg).
6. Place V-belt on the gearbox sheave and adjust belt tension as indicated in Table 8-2. Install V-belt guard. DO NOT START UNIT UNTIL V-BELT GUARD IS INSTALLED.
7. Reconnect negative battery cable. Start unit and run for 10 minutes to allow for belt stretch.
8. Disconnect battery. Turn unit off, remove belt and recheck belt tension. Install belt guard.

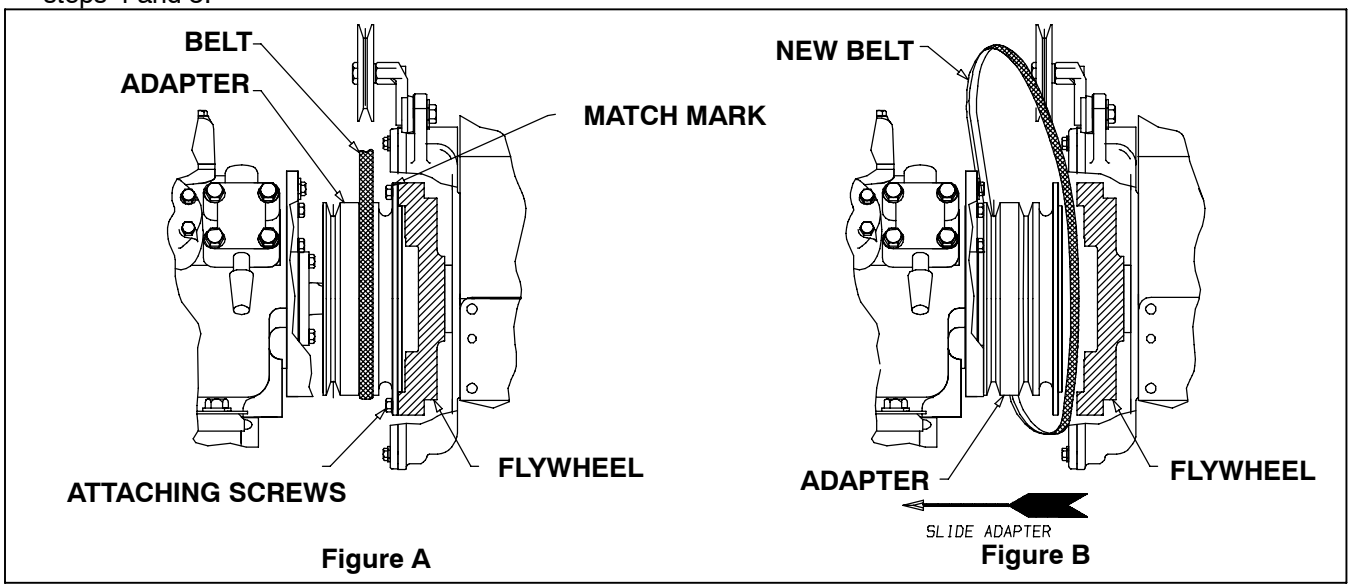


Figure A **Figure B**

Figure 8–13. Removing V-Belt from Engine Adapter Drive Sheave

8.8 FANSHAFT ASSEMBLY - SEE FIGURE 8-14

⚠ WARNING

Beware of V-belts and belt driven components as the unit may start automatically. Before servicing unit, make sure the START/RUN-OFF switch is in the OFF position or the unit is in Maintenance mode. Also disconnect the negative battery cable.

⚠ WARNING

UNITS EQUIPPED WITH STAR-TRAK TWO WAY COMMUNICATION CAPABILITIES MAY HAVE THE ABILITY TO BE STARTED OR TURNED OFF REMOTELY REGARDLESS OF THE SETTING OF THE START/RUN-OFF SWITCH.

The unit is controlled locally and there can be no two-way communication when the mode switch on the Remote Monitoring Control Box is in MAINTENANCE MODE. Therefore, when performing any work on the unit, place the mode switch in MAINTENANCE MODE. After the unit is serviced, return the mode switch to REMOTE ON. (Refer to Section 3.19.3 for more information on two-way communication.)

8.8.1 Clutch Removal

⚠ CAUTION

Do not get anti-seize oil/compound onto clutch contact surfaces. Thoroughly clean off oil/compound with contact or brake cleaner if this occurs.

a. Turn the START/RUN-OFF switch to OFF and disconnect the negative battery cable.

b. Loosen the fan belt idler and remove upper drive belt.

c. Remove the top eight bolts (four along top edge and two down each side) that hold fan shroud to condenser frame.

d. Remove the three bolts that thread through the back of the clutch rotor/pulley forward into the condenser fan hub. Carefully remove the condenser fan and hub assembly from unit.

e. Place the three pins of the spanner wrench (CTD P/N 07-00396-01) into the holes on the face of the clutch armature. Place the tool handle between the fan shaft frame support and pod (10 o'clock position) to provide hands free anti-rotation. Loosen and remove the armature retaining bolt and washer.

NOTE

The armature-retaining bolt is a **LEFT HAND THREAD BOLT.**

f. Remove the clutch armature. A standard 5/8"-11 X 1" right hand thread bolt can be threaded through the center to jack the armature off the shaft, if needed.

g. Use spanner socket (CTD P/N 07-00303-02) to remove the spanner nut that secures the clutch rotor.

NOTE

The armature-retaining bolt is a **LEFT HAND NYLOCK THREAD BOLT.**

h. Slide off and remove the clutch rotor/pulley. If the rotor will not slide off easily, remove the condenser fan hub adapter from the fan. Place the adapter backwards against the fan shaft hub, and thread three 5/16-18 X 2 3/4" long bolts from the back of the rotor forward into the hub adapter. Tighten the bolts evenly to pull the rotor off the fan shaft hub.

i. Unplug the clutch coil connector from the wiring harness, then remove the clutch coil. **Be sure to retain all shims on fan shaft hub, correctly positioned on Fanshaft pin..**

j. Remove the vent hose and 1/8" barb fitting from fan shaft hub. Install a plug to prevent oil from spilling out vent hole while removing fan shaft.

8.8.2 Blower Wheel And Fanshaft Removal

a. Remove bulkhead and air chute (if so equipped). Remove evaporator back panel.

b. Remove the bolts that secure DTT2 and SAT to the nozzle cover. Care should be taken to prevent cutting wires on evaporator coil.

c. Remove the remaining bolts in the nozzle cover and carefully remove it from the pod.

NOTE

The nozzle cover (CTD P/N 58-04469-00) is sealed with a gasket (CTD P/N 42-00506-00). If the gasket is damaged during removal, it **MUST** be replaced.

d. Remove the two 1/4"-20 X 1" long bolts from the blower wheel split taper bushing. Insert them into the threaded holes. Tighten bolts evenly to push the blower wheel away from the bushing.

e. Remove the fan shaft seal ring clamp and carefully peel seal from pod (use a putty knife if needed).

NOTE

The fan shaft seal (CTD P/N 42-00372-00) is caulked to the pod. If seal is damaged during removal, it **MUST** be replaced.

f. Remove the four 3/8" bolts from the fan shaft.

g. Remove fan shaft from unit.

8.8.3 Fanshaft Installation

a. Install two keys into the shaft keyways.

NOTE

If it is necessary to drive the keys into place, be sure to support the shaft while tapping the keys.

b. Position the fan shaft so that the housing is in the normal mounting position, with the shaft horizontal and the vent hole facing directly up. Remove both pipe plugs (1/8" NPT) from fan shaft.

c. Ensure oil in fan shaft is at proper level. If not, fill the fan shaft with oil (07-00373-00) until oil is at the bottom of the level hole (approximately 3 oz/89 ml). Apply pipe thread sealant to the pipe plug on the side of fan shaft housing and tighten. Reinstall pipe plug on hub to prevent oil spillage.

d. Install the fan shaft into the unit with the four fan shaft mounting bolts and torque bolts to 28 to 30 ft-lb (3.9 to 4.1 Mkg), making sure the plug for the vent is pointing up.

NOTE

To aid in fan shaft alignment, install two 3/8"-16 x 1 1/2" studs (bolts with heads cut off) into the fan shaft mounting hub. Once the first two fan shaft mounting bolts are loosely installed, remove the studs and install bolts.

e. Apply pipe thread sealant to barb fitting and install into vent hole. Slide hose vent onto barb fitting.

f. Apply caulk to the fan shaft seal and place on the fan shaft. Place fan shaft seal ring clamp on seal and tighten.

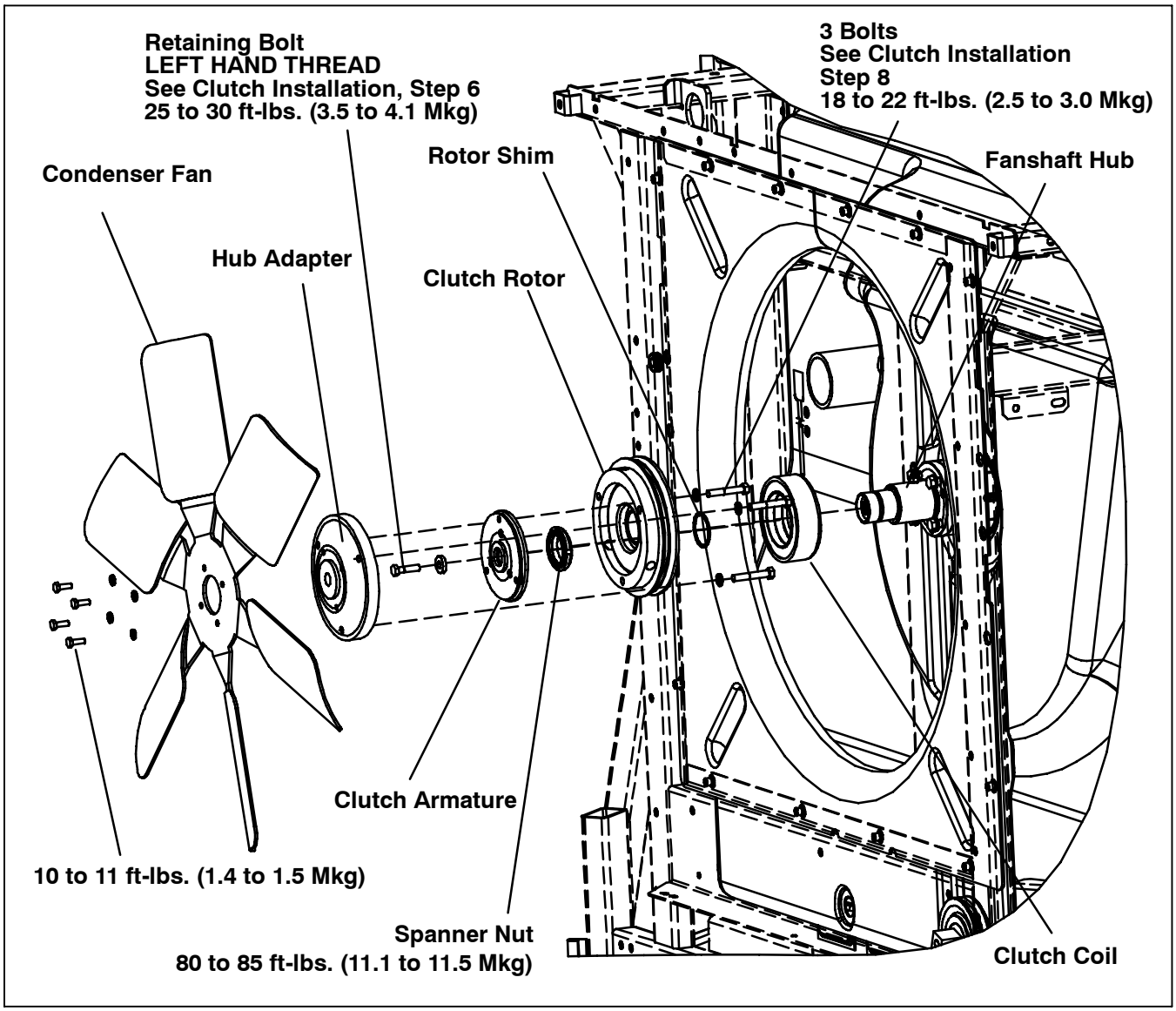


Figure 8-14. Fanshaft Assembly

8.8.4 Blower Wheel Installation

a. Make sure key is properly placed in keyway. Slide blower wheel and bushing onto shaft.

b. Loosely attach blower wheel to bushing and slide assembly forward until blower wheel touches pod. (This will set approximate clearance between blower wheel and pod.)

c. Loosely attach the nozzle cover to pod with retaining bolts. Install SAT with at least 1/2" of sensor in the nozzle. Reattach DTT2.

d. Slowly and evenly torque blower wheel bushing bolts to 10 to 11 ft-lbs (1.4 to 1.5 Mkg)

e. Position nozzle cover so that blower wheel is centered in cover opening. Torque nozzle cover bolts to 20 in-lbs (0.23 Mkg).

f. Rotate blower wheel and check that clearance is approximately 1/4." Adjust nozzle cover and/or blower wheel if necessary.

g. Reinstall evaporator panel, reattach air chute and bulkhead (if so equipped).

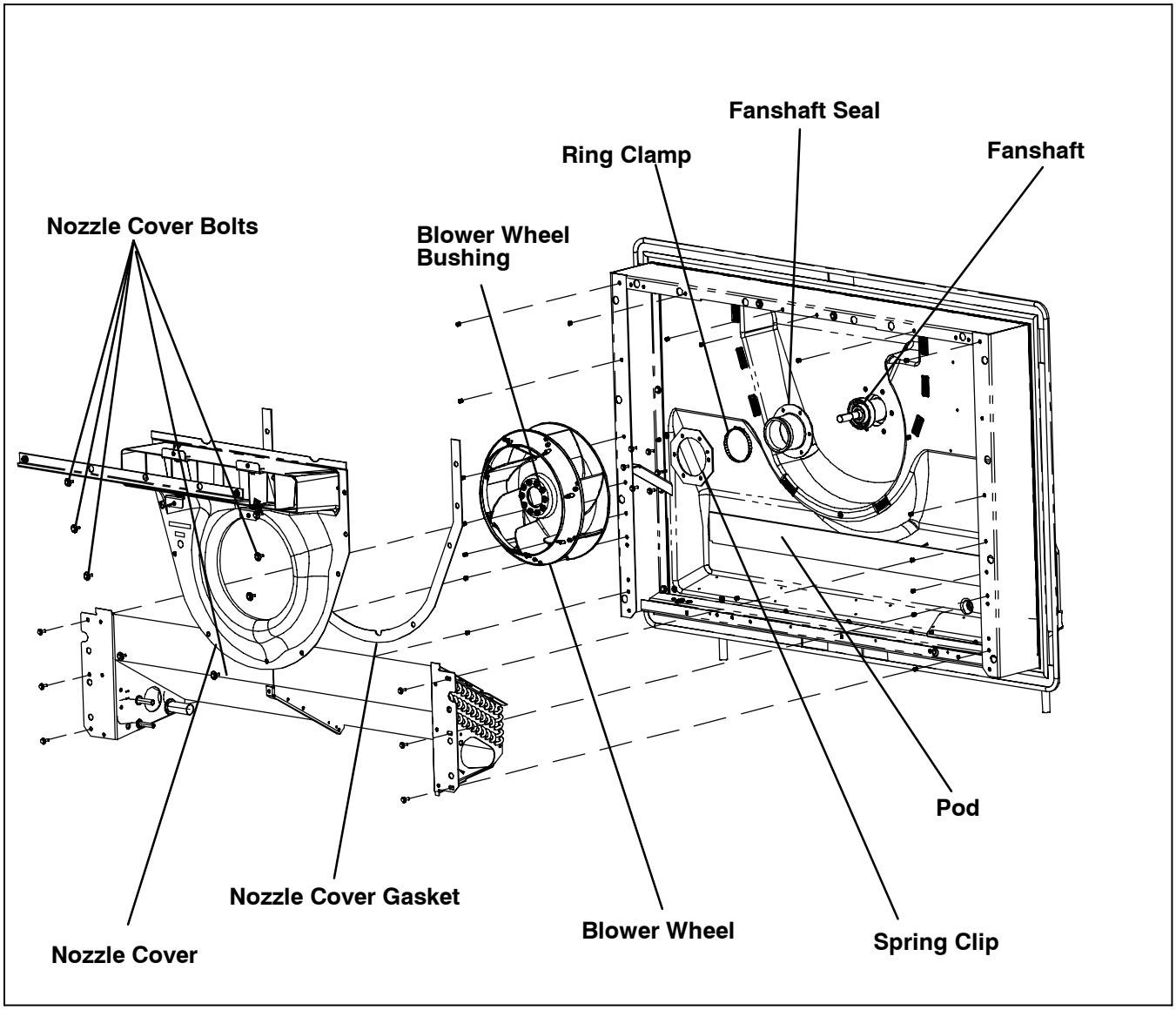


Figure 8-15. Blower Wheel And Nozzle Cover Assembly

8.8.5 Clutch Installation

NOTE

The orientation of the clutch coil **MUST** be on the bottom. Secure the harness to the lower right fan shaft mounting bolt using the cushion clamp provided.

a. Place clutch coil onto fan shaft hub, with coil harness on top. **Make sure all original shims are correctly positioned on fan shaft pin** and then slide coil onto hub so fan shaft pin fits into notch in coil.

NOTE

The fan shaft pin is used to position the coil to properly secure the wire harness to the frame.

b. Install rotor spacer and rotor onto the fan shaft.

c. Install the new spanner nut (included in mounting accessory kit (CTD P/N 50-00236-21.) Use CTD spanner socket 07-00303-02 and torque to 80-85 ft-lbs (11.1 to 11.5 Mkg.)

NOTE

The spanner nut is a **LEFT HAND NYLOCK-THREAD NUT.**

d. Slide the armature into place on the fan shaft, making sure the key is in place and the keyway lines up correctly with the shaft key.

e. Install the new armature retaining bolt and washer. Use spanner wrench (CTD P/N 07-00396-01) at the 2 o'clock position to hold the armature, then torque the retaining bolt to 25-30 ft-lb. (3.5 to 4.1 Mkg)

NOTE

The armature retaining bolt is a **LEFT HAND THREAD BOLT.**

f. Measure the clutch air gap with the air gap tool (CTD P/N 07-00432-00). The gap should be between 0.015 and 0.050 inches (0.38 and 12.7mm). If it is not, remove entire clutch. If gap is less than 0.050" (12.7mm), remove one of the fan shaft hub shims. If the gap is more than 0.050" (12.7mm), add enough shims to reduce gap to approximately 0.020" (0.51mm). Shims (CTD P/N 50-00232-30 are 0.010" (0.25mm) each. Reinstall clutch assembly.

g. Install cushion clamp on coil harness approximately 3" from coil to prevent harness from rubbing on rotor.

h. Reattach the condenser fan and hub assembly to the clutch rotor. Thread the three bolts from behind the clutch rotor into the condenser fan hub, and torque the bolts to 18-22 ft-lb. (2.5 to 3.0 Mkg).

i. Reinstall the upper drive belt and adjust idler to attain a belt tension of 70-80 ft-lb. (9.7 to 11.1 Mkg)

j. Remove condenser fan shroud spacer/supports that may have been inserted. Reinstall upper eight bolts that hold shroud to condenser frame.

k. Plug the clutch coil connector back into the wiring harness. Tie-wrap harness as needed to secure.

l. Re-connect negative battery cable.

m. Check unit for proper clutch operation.

⚠ WARNING

Do not start unit without installing the evaporator panels as unit damage or body harm may result.

n. Check for proper unit operation by running Pretrip (Refer to Section 3.3).

8.9 PUMPING UNIT DOWN OR REMOVING REFRIGERANT CHARGE

NOTE

To avoid damage to the earth's ozone layer, use a refrigerant recovery system whenever removing refrigerant. When working with refrigerants you must comply with all local government environmental laws, U.S.A. EPA section 608.

⚠ CAUTION

Service mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating. Refer to Section 5.2.3.

⚠ WARNING

UNITS EQUIPPED WITH STAR-TRAK TWO WAY COMMUNICATION CAPABILITIES MAY HAVE THE ABILITY TO BE STARTED OR TURNED OFF REMOTELY REGARDLESS OF THE SETTING OF THE START/RUN-OFF SWITCH.

The unit is controlled locally and there can be no two-way communication when the mode switch on the Remote Monitoring Control Box is in MAINTENANCE MODE. Therefore, when performing any work on the unit, place the mode switch in MAINTENANCE MODE. After the unit is serviced, return the mode switch to REMOTE ON. (Refer to Section 3.19.3 for more information on two-way communication.)

8.9.1 Pumping Down The Unit

In order to service the components downstream of the king valve (and back to the compressor), the unit can be pumped down in the standard manner:

a. Backseat suction and discharge service valves (turn counterclockwise) to close off gauge connection and attach manifold gauges to valves.

b. Open valves two turns (clockwise). Purge gauge lines.

c. Frontseat the receiver manual shut-off valve (king valve) by turning clockwise. Start unit and run in high speed cooling. Place START/RUN-OFF switch in the OFF position when compressor suction pressure approaches 1 PSIG (0.07 Bar).

⚠ CAUTION

Do not allow suction pressure to go below 0 Psig/Bar.

d. If the compressor does not pump down to 1 PSIG (0.07 Bar) there may be a problem with the compressor reed valves or other internal components. See Section 8.13.

e. Frontseat (close by turning clockwise) suction service valve and the refrigerant will be trapped between the compressor suction service valve and the manual shut-off valve (king valve).

f. Check the manifold gauge pressure prior to opening the refrigeration system. If the pressure rises, the discharge check valve may be leaking refrigerant back into the system. Check and replace if necessary. See Section 8.16

g. Before opening up any part of the system, a slight positive pressure should be indicated on the pressure gauge.

h. When opening up the refrigerant system, certain parts may frost. Allow the part to warm to ambient temperature before dismantling. This avoids internal condensation, which puts moisture in the system.

i. After making necessary repairs, leak test and evacuate the low side of the refrigeration system. (Refer to Sections 8.10 and 8.11.)

j. Backseat manual shut-off valve (king valve) and midseat suction service valve.

k. Start the unit in cooling and check for noncondensibles.

l. Check the refrigerant charge. (Refer to Section 8.12.1.)

NOTE

Store the refrigerant charge in an evacuated container if the system must be opened between the compressor discharge valve and receiver. Whenever the system is opened, it must be evacuated and dehydrated. (Refer to Section 8.11)

8.9.2 Removing The Refrigerant Charge

Connect a refrigerant recovery system to the unit to remove refrigerant charge. Refer to instructions provided by the manufacture of the refrigerant recovery system.

⚠ CAUTION

Service mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating. Refer to Section 5.2.3.

8.10 REFRIGERANT LEAK CHECKING

⚠ WARNING

UNITS EQUIPPED WITH STAR-TRAK TWO WAY COMMUNICATION CAPABILITIES MAY HAVE THE ABILITY TO BE STARTED OR TURNED OFF REMOTELY REGARDLESS OF THE SETTING OF THE START/RUN-OFF SWITCH.

The unit is controlled locally and there can be no two-way communication when the mode switch on the Remote Monitoring Control Box is in MAINTENANCE MODE. Therefore, when performing any work on the unit, place the mode switch in MAINTENANCE MODE. After the unit is serviced, return the mode switch to REMOTE ON. (Refer to Section 3.19.3 for more information on two-way communication.)

a. If the system was opened and repairs completed, leak check the unit and replace filter drier.

b. The recommended procedure for finding leaks in a system is to use an electronic leak detector. Testing joints with soapsuds is satisfactory only for locating large leaks, or pinpointing small leaks once a general area has been located.

c. If the system is without refrigerant, charge system with refrigerant to build up pressure between 30 to 50 PSIG (2.04 to 3.40 Bars). Remove refrigerant drum and leak check all connections.

⚠ CAUTION

Only a refrigerant drum containing R404a should be connected to units covered by this manual in order to pressurize the system. Any other gas or vapor will contaminate the system, which will require additional purging and evacuation of the high side (discharge) of the system.

d. Remove refrigerant using a refrigerant recovery system and repair any leaks. Evacuate and dehydrate the unit. (Refer to Section 8.11) Charge unit with refrigerant. (Refer to Section 8.12)

e. Check for proper unit operation by running Pretrip (Refer to Section 3.3).

8.11 EVACUATION AND DEHYDRATION

8.11.1 General

Moisture is the enemy of refrigerant systems. The presence of moisture in a refrigeration system can have many undesirable effects. The most common are copper plating, acid sludge formation, “freezing-up” of metering devices (TXV) by free water, and formation of acids, resulting in metal corrosion.

8.11.2 Preparation

a. Evacuate and dehydrate only after pressure leak test. (Refer to Section 8.10)

b. Essential tools to properly evacuate and dehydrate any system include a good vacuum pump (5 cfm / 8m3H volume displacement, P/N 07-00176-11) and a good vacuum indicator such as a thermocouple vacuum gauge (vacuum indicator). (07-00414-00)

NOTE

The use of a manifold gauge is not recommended because of its inherent inaccuracy.

c. Keep the ambient temperature above 60°F (15.6°C) to speed evaporation of moisture. If ambient temperature is lower than 60°F (15.6°C), ice might form before moisture removal is complete. Heat lamps or alternate sources of heat may be used to raise system temperature.

8.11.3 Procedure For Evacuation And Dehydrating System

NOTE

Standard service hoses are not suitable for evacuation purposes.

a. Remove refrigerant using a refrigerant recovery system.

b. The recommended method to evacuate and dehydrate the system is to connect three evacuation hoses as shown in Figure 8–16 to the vacuum pump and refrigeration unit. Also, as shown, connect an evacuation manifold, with evacuation hoses only, to the vacuum pump, electronic vacuum gauge, and refrigerant recovery system.

c. With the unit service valves closed (back seated) and the vacuum pump and electronic vacuum gauge valves open, start the pump and draw a deep vacuum. Shut off the pump and check to see if the vacuum holds. This operation is to test the evacuation setup for leaks, repair if necessary.

d. Midseat the refrigerant system service valves.

e. Open the vacuum pump and electronic vacuum gauge valves, if they are not already open. Start the vacuum pump. Evacuate unit until the electronic vacuum gauge indicates 2000 microns. Close the electronic vacuum gauge and vacuum pump valves. Shut off the vacuum pump. Wait a few minutes to be sure the vacuum holds.

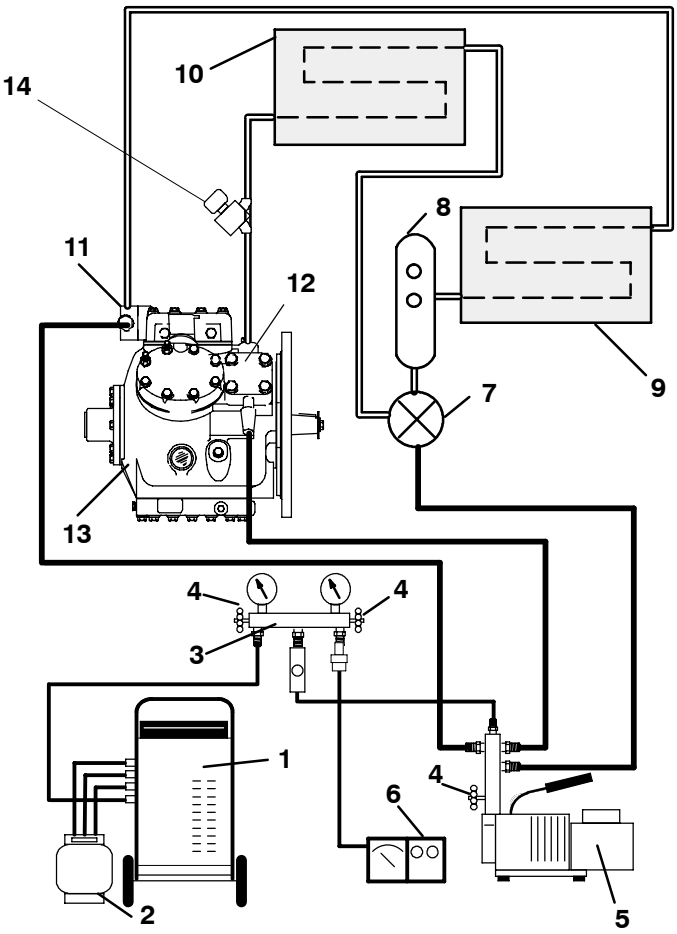
f. Break the vacuum with dry nitrogen. Raise system pressure to approximately 2 PSIG (0.14 Bar).

g. Purge nitrogen from system.

h. Repeat steps e through g one time.

i. Evacuate unit to 500 microns. Close off vacuum pump valve and stop pump. Wait five minutes to see if vacuum holds. This checks for residual moisture and/-or leaks.

j. With a vacuum still in the unit, the refrigerant charge may be drawn into the system from a refrigerant container on weight scales. The correct amount of refrigerant may be added by observing the scales. Correct charge will be found in Table 2-1.



1. Refrigerant Recovery Unit
2. Refrigerant Cylinder
3. Evacuation Manifold
4. Valve
5. Vacuum Pump
6. Vacuum Gauge
7. King Valve
8. Receiver
9. Condenser
10. Evaporator
11. Discharge Service Valve
12. Suction Service Valve
13. Compressor
14. Compressor Suction Modulation Valve (CSMV)

Figure 8-16. Vacuum Pump Connection

8.12 ADDING REFRIGERANT TO SYSTEM

⚠ CAUTION

Service mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating. Refer to Section 5.2.3.

⚠ WARNING

UNITS EQUIPPED WITH STAR-TRAK TWO WAY COMMUNICATION CAPABILITIES MAY HAVE THE ABILITY TO BE STARTED OR TURNED OFF REMOTELY REGARDLESS OF THE SETTING OF THE START/RUN-OFF SWITCH.

The unit is controlled locally and there can be no two-way communication when the mode switch on the Remote Monitoring Control Box is in MAINTENANCE MODE. Therefore, when performing any work on the unit, place the mode switch in MAINTENANCE MODE. After the unit is serviced, return the mode switch to REMOTE ON. (Refer to Section 3.19.3 for more information on two-way communication.)

⚠ CAUTION

Do not vapor charge R-404A. Only liquid charging through the receiver outlet (king) valve is acceptable.

8.12.1 Checking The Refrigerant Charge

NOTE

High speed operation at some conditions may create high turbulence inside the receiver. If it is difficult to see the refrigerant settling properly in the receiver sight glass, unplug the speed solenoid, forcing low speed operation. There should be less turbulence in the receiver and the liquid refrigerant should settle properly.

Checking Refrigerant Level on Units With S/N Prior to JAR90710713

NOTE

The ambient (air entering the condenser) air temperature should be above 40°F (4.4°C)

a. Start unit in cooling mode. Run approximately ten minutes - until the refrigeration system is warmed up and the refrigerated compartment temperature is less than 45°F (7.2C).

b. Check the lower sight glass on the receiver to determine charge. The system is correctly charged when refrigerant level is at centerline of sight glass, then weigh in another 3 lbs. (1.4 kg) of refrigerant.

Checking Refrigerant Level on Units With S/N Beginning With JAR90710713

NOTE

The ambient (air entering the condenser) air temperature should be above 40°F (4.4°C)

a. Start unit in cooling mode. Run approximately ten minutes – until the refrigeration system is warmed up and the refrigerated compartment temperature is less than 45°F (7.2C).

b. Check the lower sight glass to determine charge. The system is correctly charged when **the lower sight glass is not empty and the upper sight glass is not full**.

c. If the system appears to be overcharged: Remove refrigerant through the king valve to correct refrigerant level.

d. If the refrigerant system appears to be undercharged: Add refrigerant through the king valve.

8.12.2 Partial Charge

⚠ CAUTION

Do not vapor charge R-404A. Only liquid charging through the receiver outlet (king) valve is acceptable.

NOTE

The ambient (air entering the condenser) air temperature should be above 40°F (4.4°C)

a. Place drum of refrigerant on scale and note weight. Backseat discharge and suction service valves and install a manifold gauge set. Purge lines. Connect a second manifold test set discharge gauge to the king valve. Connect the suction pressure hose to manifold dead head port. Connect a charging line between the center tap of the second gauge set and refrigerant drum. Open the LIQUID valve on drum and purge all hoses.

b. Start the unit. Adjust the setpoint so that the unit will run in high speed cool mode.

c. Run the unit for approximately ten minutes – until the refrigeration system is warmed up and the refrigerated compartment temperature is less than 45°F (7.2C).

d. Check the appropriate sight glass to determine charge. (See Step g. for determination of charge.) If undercharged proceed with step e.

e. Frontseat the king valve, and monitor the second set of manifold gauges. When the king valve pressure drops below the pressure in the refrigerant drum, open the manifold gauge set discharge valve and allow liquid refrigerant to flow into the system.

f. While monitoring the appropriate sight glass, carefully weigh the refrigerant into the system. Because the unit is in this charging state, it is not possible to accurately determine when the system is full. Therefore, never allow more than 3 lbs. (1.4 kg) of refrigerant into the system at a time.

g. After metering 3 lbs (1.4 kg) of refrigerant into the system, close the valve of the manifold gauge set connected to the king valve. Open the king valve and allow the system to balance out (approximately 4-5 minutes and the refrigerated compartment temperature is less than 45°F (7.2C). Check sight glass(es) to determine charge:

Units With S/N Prior to JAR90710713 – Once the refrigerant level is at centerline of the lower sight glass, weigh in another 3 lbs. (1.4 kg) of refrigerant.

Units With S/N Beginning With JAR90710713 – Charge the system until the refrigerant level is at centerline of the lower sight glass. THE LOWER SIGHT GLASS SHOULD NOT BE EMPTY AND THE UPPER SIGHT GLASS SHOULD NOT BE FULL.

h. Start unit and check for noncondensibles and run a unit Pretrip. (Refer to Section 3.3).

8.12.3 Adding Full Charge

⚠ CAUTION

Do not vapor charge R-404A. Only liquid charging through the receiver outlet (king) valve is acceptable.

a. Dehydrate unit to 500 microns and leave in deep vacuum. (Refer to Section 8.11.3)

b. Place drum of refrigerant on scale and connect charging line from drum to king valve. Purge charging line at king valve.

c. Note weight of drum and refrigerant.

d. Open liquid valve on drum. Midseat king valve and allow the liquid refrigerant to flow into the unit until the correct weight of refrigerant has been added as indicated by scales. Correct charge will be found in Table 2-1.

NOTE

It is possible that all liquid may not be pulled into the receiver, as outlined in step d. In this case, frontseat the receiver outlet valve (king valve) and run the unit in cooling until the correct amount of refrigerant is added.

e. When scale indicates that the correct charge has been added, close liquid line valve on drum and backseat the king valve. Remove charging hose.

f. Start unit and check for noncondensibles and run a unit Pretrip. (Refer to Section 3.3).

8.13 REPLACING THE COMPRESSOR

⚠ CAUTION

Service mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating. Refer to Section 5.2.3.

⚠ WARNING

UNITS EQUIPPED WITH STAR-TRAK TWO WAY COMMUNICATION CAPABILITIES MAY HAVE THE ABILITY TO BE STARTED OR TURNED OFF REMOTELY REGARDLESS OF THE SETTING OF THE START/RUN-OFF SWITCH.

The unit is controlled locally and there can be no two-way communication when the mode switch on the Remote Monitoring Control Box is in MAINTENANCE MODE. Therefore, when performing any work on the unit, place the mode switch in MAINTENANCE MODE. After the unit is serviced, return the mode switch to REMOTE ON. (Refer to Section 3.19.3 for more information on two-way communication.)

NOTE

The service replacement compressor is sold without shutoff valves (but with valve pads). The valve pads should be installed on the removed compressor prior to return shipping. Customer should retain the original capacity unloader valves for use on replacement compressor. Check oil level in service replacement compressor. (Refer to Section 8.14)

If compressor is inoperative and unit still has refrigerant pressure, frontseat suction and discharge service valves to trap most of the refrigerant in the unit.

If compressor runs, pump down the unit. (Refer to Section 8.11.)

If compressor does not operate, frontseat both suction and discharge service valves, and remove refrigerant charge from compressor (Refer to Section 8.9.2.)

a. Disconnect negative battery cable.

b. Remove the two rear compressor bracket mounting bolts (compressor shockmount end).

c. Block up engine.

d. Back out suction and discharge service bolt valve flange by two complete revolutions and leave threads engaged.

e. Break seal between service valves and compressor and remove bolts from valve flanges.

f. Remove fuel filter bracket (if necessary) from the compressor bell housing.

g. Disconnect wiring to unloader valve assemblies, Compressor Discharge Temperature Sensor (CDT), Compressor Discharge Pressure Transducer (CDP), Compressor Suction Pressure Transducer (CSP) and the wiring to the high pressure cutout switch (HPS). Identify wiring and switches if necessary. (See Figure 8-17)

h. Remove 10 bolts from the engine-compressor bell housing.

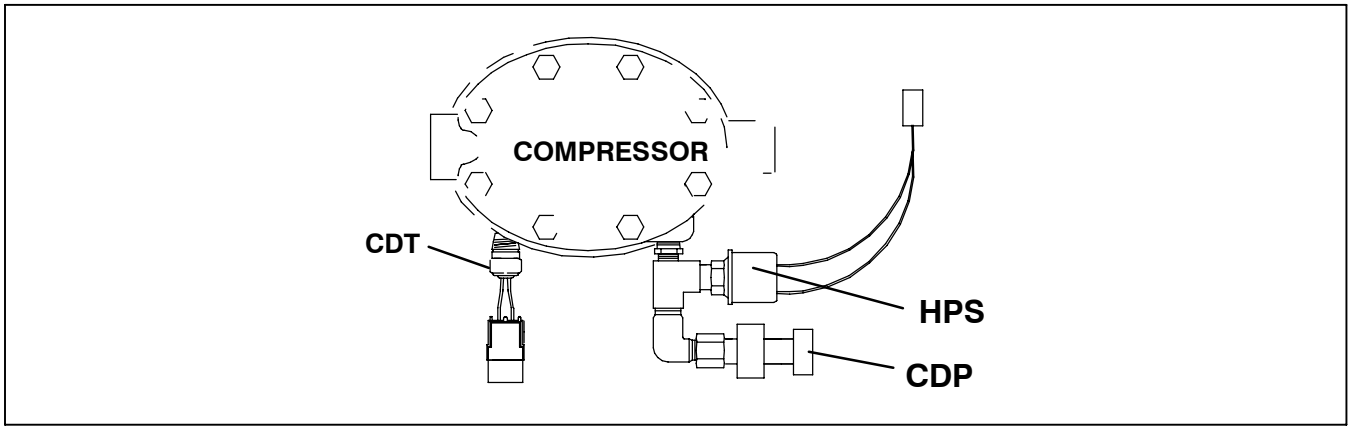


Figure 8-17. Pressure Switch and Sensor

i. Disconnect ground strap from frame.

j. Remove Suction Pressure Transducer from suction line.

k. Attach sling or other device to the compressor.

l. Slide compressor enough to clear nylon drive gear (as shown in Figure 8-18), and remove compressor from unit.

m. Drain oil from defective compressor before shipping.

n. The original unloader valves must be transferred to the replacement compressor. The plug arrangement removed from the replacement is installed in the original compressor as a seal. If piston is stuck, it may be extracted by threading socket head cap screw into top of piston. A small Teflon seat ring at bottom of piston must be removed.

o. Remove the complete High Pressure switch assembly (HPS) (See Figure 8-17) and install on new compressor after checking switch settings. Remove Compressor Discharge Temperature sensor (CDT), Compressor Discharge Pressure transducer (CDP), and Compressor Suction Pressure transducer (CSP) and install on new compressor. Install compressor frame to new compressor (if removed with defective compressor).

p. Install compressor in unit by reversing step 4.12.b. through n. The use of new locknuts is recommended when replacing compressor. Torque bolts to a value of 46 ft/lb (6.4 Mkg). Install new gaskets on service valves and tighten bolts uniformly. Refer to Section 8.30.1 - drive gear installation.

q. Attach two lines (with hand valves near vacuum pump) to the suction and discharge service valves. Leak test, then dehydrate and evacuate compressor to 500 microns (29.90" Hg vacuum = 75.9 cm Hg vacuum). Turn off valves on both lines to pump.

r. Fully backseat (open) both suction and discharge service valves.

s. Remove vacuum pump lines and install manifold gauges.

t. Check refrigerant level.

NOTE

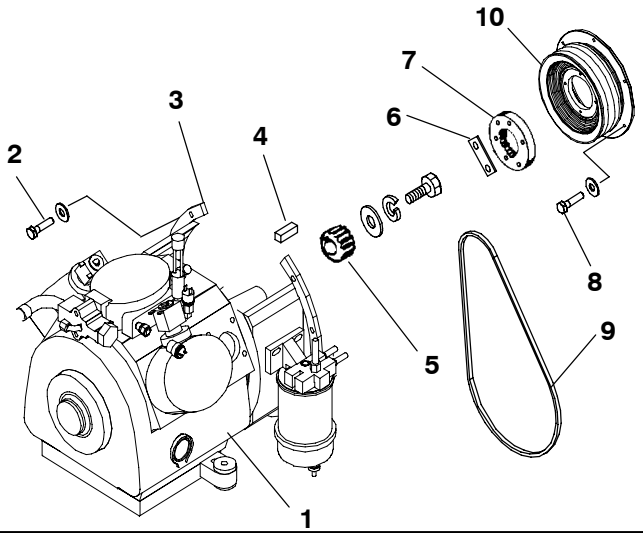
Remanufactured compressors are shipped without oil. Do not start unit without adding oil. See Section 2.9 for correct charge.

u. Start unit and check for noncondensibles.

v. Check compressor oil level. (Refer to Section 8.14) Add oil if necessary.

w. Check compressor unloader operation. (Refer to Section 8.15)

x. Check refrigerant cycles by running a unit Pretrip. (Refer to Section 3.3)



1. Compressor
2. Bolts
3. Compressor Bell Housing
4. Key
5. Compressor Drive Gear
6. Locking Tab
7. Nylon Drive Gear
8. Drive Sheave Bolts
9. V-Belt
10. Engine Adapter Drive Sheave

Figure 8-18. Compressor Drive Assembly

8.14 CHECKING COMPRESSOR OIL LEVEL

⚠ CAUTION

Service mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating. Refer to Section 5.2.3.

⚠ WARNING

UNITS EQUIPPED WITH STAR-TRAK TWO WAY COMMUNICATION CAPABILITIES MAY HAVE THE ABILITY TO BE STARTED OR TURNED OFF REMOTELY EVEN IF THE START/RUN-OFF SWITCH IS IN THE OFF POSITION.

The unit is controlled locally and there can be no two-way communication when the mode switch on the Remote Monitoring Control Box is in MAINTENANCE MODE. Therefore, when performing any work on the unit, place the mode switch in MAINTENANCE MODE. After the unit is serviced, return the mode switch to REMOTE ON. (Refer to Section 3.19.3 for more information on two-way communication.)

8.14.1 To Check The Oil Level In The Compressor:

a. Operate the unit in high speed, fully loaded cool for at least 15 minutes. Unplug wires to the unloaders if necessary to ensure six cylinder operation.

NOTE

Check the oil sight glass on the compressor to ensure that no foaming of the oil is present after 15 minutes of operation. If the oil is foaming check the refrigerant system for flood-back of liquid refrigerant. Correct this situation before performing step 2.

b. After 15 minutes, initiate a defrost cycle. This will allow any residual oil to be returned to the compressor.

NOTE

Operate the unit in defrost for 3-5 minutes only. **Do not allow the unit to terminate defrost automatically.** The sudden reduction of crankcase pressure at defrost termination could cause a temporary increase in oil circulation and gave a false oil level reading.

c. After 3-5 minutes of defrost operation, turn the unit off and wait 5-15 seconds. Observe the compressor oil level in the sight glass. (See Figure 8-19). Oil level should be between the Minimum and Maximum marks.

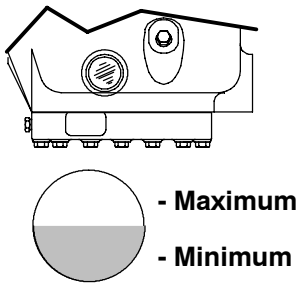


Figure 8-19. Oil Level in Sight Glass

8.14.2 Adding Oil With Compressor In System

Two methods for adding oil are the oil pump method and closed system method.

a. Oil Pump Method

One compressor oil pump that may be purchased is a Robinair, part no. 14388. This oil pump adapts to a one U.S. gallon (3.785 liters) metal refrigeration oil container and pumps 2-1/2 ounces (0.0725 liters) per stroke when connected to the oil fill (item 3, Figure 8–20). There is no need to remove pump from can after each use.

When the compressor is in operation, the pump check valve prevents the loss of refrigerant, while allowing the technician to develop sufficient pressure to overcome the operating suction pressure to add oil as necessary.

Backseat suction service valve and connect oil charging hose to oil fill (Item 3, Figure 8–20). Purge the oil hose at oil pump. Add oil as necessary (Refer to Section 2.9).

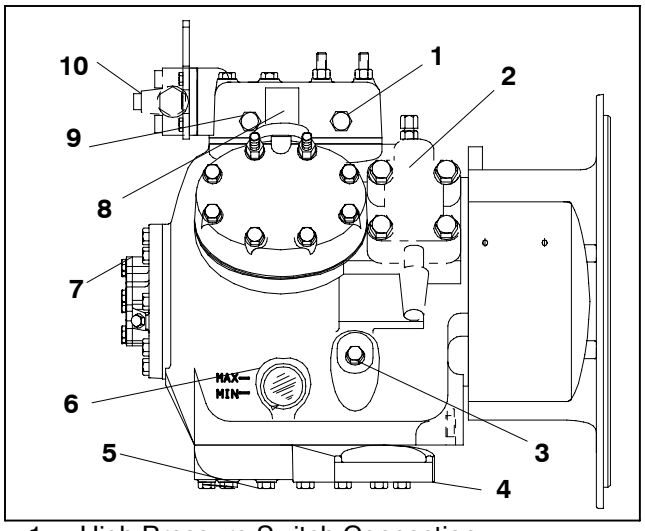
b. Closed System Method

⚠ CAUTION

Extreme care must be taken to ensure the hose is immersed in the oil at all times. Otherwise air and moisture will be drawn into the compressor.

When an oil pump is not available, oil may be drawn into the compressor through the oil fill port or through the suction service valve.

1. Connect the suction connection of the gauge manifold to the compressor suction service valve port, and the common connection of the gauge manifold to a vacuum pump. Remove the discharge hose from the gauge manifold; connect one end to the compressor oil fill port, and immerse the other end in an open container of refrigeration oil. Start the vacuum pump, and pull the compressor into a 10”-15” vacuum. Stop the pump. Watch the oil level in the sight glass. As it reaches the minimum mark, stop the flow of oil from the container. (Refer to Section 2.9).
2. Break any remaining vacuum (raise to 0 Bar/PSIG) with refrigerant remaining in the system (crack open the suction service valve), or from a fresh drum of refrigerant. Replace the oil port plug, and evacuate the compressor crankcase. Open both service valves before starting the unit.



1. High Pressure Switch Connection
2. Suction Service Valve
3. Oil Fill Plug
4. Bottom Plate
5. Oil Drain Plug
6. Oil Level Sight Glass
7. Oil Pump
8. Unloader Solenoid
9. Discharge Thermistor Connection
10. Discharge Service Valve

Figure 8–20. Compressor

8.14.3 Adding Oil To Service Replacement Compressor

Service replacement compressors may or may not be shipped with oil.

If compressor is without oil:

Add correct oil charge (Refer to Section 2.9) through the suction service valve flange cavity or by removing the oil fill plug (See Figure 8–20)

8.14.4 To Remove Oil From The Compressor:

a. Close suction service valve (frontseat) and pump unit down to 0.07 to 1 to 2 PSIG (0.1 Bar). Frontseat discharge service valve and slowly bleed remaining refrigerant.

b. Slowly remove the oil drain plug from the compressor and drain the proper amount of oil. Replace the plug securely back into the compressor.

c. Open service valves and run unit to check oil level, repeat as required to ensure proper oil level.

8.15 COMPRESSOR UNLOADER VALVE

The compressor unloaders (located on the compressor cylinder heads) are controlled by the Advance Microprocessor. (Refer to Section 2.3.4)

8.15.1 Checkout Procedure

a. Connect manifold gauges to the compressor suction and discharge service valves and start unit in cooling with the setpoint within 1 to 2°F (0.6 to1.1°C) of the refrigerated compartment temperature.

b. Unplug both unloader coils. The compressor should be operating with all six cylinders. Note suction pressure.

c. Plug UL1 (front unloader) in. Note discharge and suction pressures, the suction pressure should rise approximately 3 PSIG (0.2 Bar), and the discharge should drop approximately 5-15 PSIG (0.35 to 1.05 Bars).

d. Unplug UL1 and note pressures. Suction pressure should drop and discharge pressure should rise by the same amounts they changed in step b. above.

e. Repeat steps c.& d. for UL2 (rear unloader). At the end of the test, plug both unloaders back in.

NOTE

If either unloader coil energizes and the suction and discharge pressures do not change, the unloader assembly must be checked.

8.15.2 Unloader Coil Replacement

NOTE

The coil may be removed without pumping the unit down.

a. Disconnect leads. Remove retainer, if equipped. Lift off coil. (See Figure 8-21)

b. Check unloader coil resistance with an ohm meter. Correct resistance should be between 7.5 and 10.5 ohms.

c. Verify coil type, voltage and frequency of old and new coil. This information appears on the coil housing.

d. Place new coil over enclosing tube and retainer and connect wiring.

e. Check unit operation by running Pretrip (Refer to Section 3.3).

8.15.3 Replacing Valve Internal Parts (See Figure 8-21)

a. Pump down the unit. (Refer to Section 8.9.1) Frontseat both service valves to isolate the compressor.

b. Remove coil retaining cap (if equipped), and coil.

c. Remove enclosing tube collar (item 2, Figure 8-21) using installation/removal tool supplied with repair kit (item 3).

d. Check plunger for restriction due to: (a) Corroded or worn parts; (b) Foreign material lodged in valve; (c) Bent or dented enclosing tube.

e. Install new parts. Do not over tighten enclosing tube assembly. Torque to a value of 8 ft pounds (1.1 Mkg).

f. Remove supplied installation/removal tool. Install coil, and voltage plate.

g. Evacuate and dehydrate the compressor. (Refer to Section 8.11.)

h. Start unit and check unloader operation (Refer to Section 8.15.1.).

i. Check unit operation by running Pretrip (Refer to Section 3.3).

⚠ CAUTION

Service mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating. Refer to Section 5.2.3.

8.16 REPLACING OR SERVICING CHECK VALVE

A check valve allows the hot gas to travel in one direction only.

The function of the Hot Gas Bypass check valve is to raise the receiver pressure when the ambient temperature is low so that refrigerant can flow from the receiver to the evaporator when the unit is in heating or defrost.

The function of the Discharge Line check valve is to prevent any liquid refrigerant from migrating into the compressor during the unit off cycle.

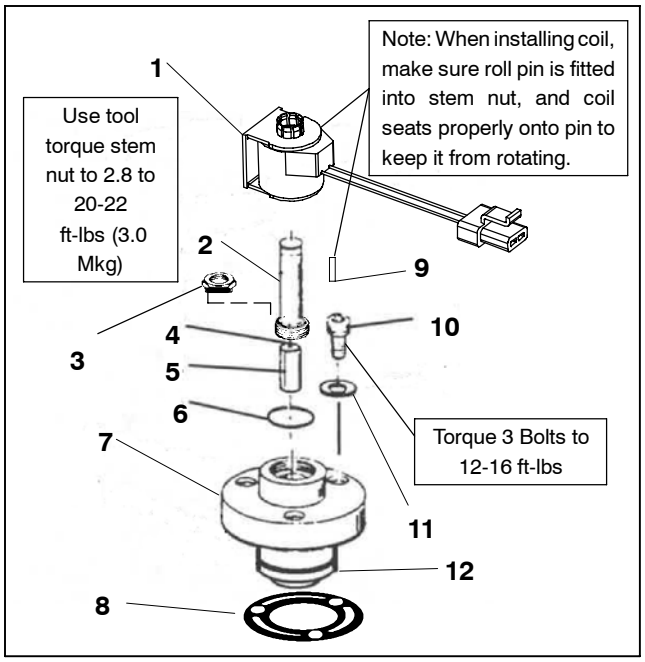
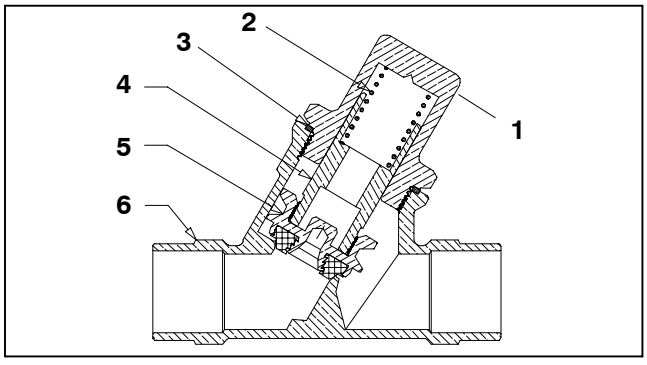


Figure 8-21. Unloader Coil

1. Coil Assembly
2. Stem/Enclosing Tube Assy
3. Installation/Removal Tool
4. Spring, Plunger
5. Plunger Assembly
6. "O" Ring
7. Valve Body
8. Gasket, Valve Body
9. Pin, Anti-Rotation (fits into top of stem nut)
10. Bolts, Valve Body (3)
11. Washers (3)
12. Piston (use only with hot gas bypass unloaders)



1. Cap
2. Spring
3. Gasket
4. Stem
5. Seat
6. Body

Figure 8-22. Discharge Check Valve (Serviceable) Prior to S/N JAW90756460

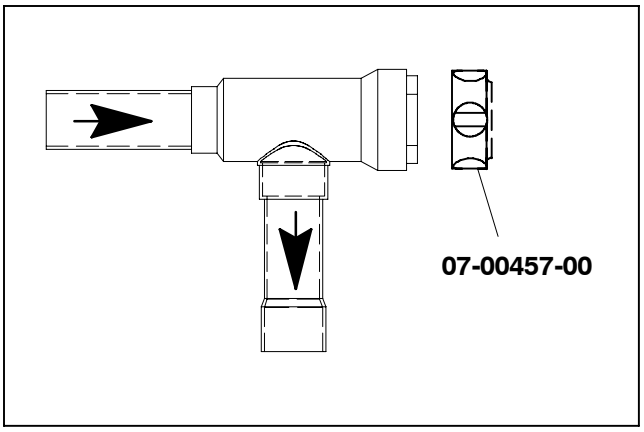


Figure 8-23. Discharge Check Valve (Non-Serviceable) Beginning With S/N JAW90756460

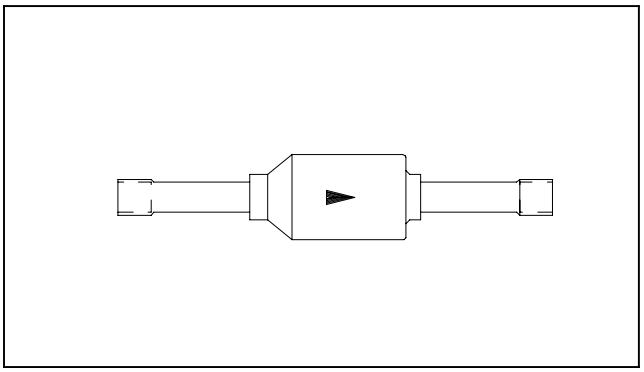


Figure 8-24. Hot Gas Check Valve (Non-Serviceable)

8.16.1 To Service Check Valve (See Figure 8-22)

a. Store the refrigerant in an evacuated container. (Refer to Section 8.9.a)

b. Replace necessary parts.

c. Evacuate and dehydrate unit. (Refer to Section 8.11)

d. Add refrigerant charge. (Refer to Section 8.12)

8.16.2 To Replace Check Valve (See Figure 8-23 and Figure 8-24)

a. Store the refrigerant in an evacuated container. (Refer to Section 8.9)

b. Using a pipe cutter, cut the valve stub-outs and unsweat the remaining stub-out from the connecting copper.

NOTE

Inert brazing techniques MUST be followed during replacement of valves.

NOTE

Place magnetic discharge check valve tool (Carrier Transicold P/N 07-00457-00) on top of discharge check valve (Figure 8-23) to pull the plunger from the body seat.

c. Replace valve.

d. Evacuate and dehydrate unit. (Refer to Section 8.11)

e. Add refrigerant charge. (Refer to Section 8.12)

f. Check unit operation by running Pretrip (Refer to Section 3.3.

8.17 CHECKING AND REPLACING FILTER-DRIER

8.17.1 To Check Filter-Drier

Check for a restricted or plugged filter-drier by feeling the liquid line inlet and outlet connections of the drier cartridge. If the outlet side feels cooler than the inlet side, then the filter-drier should be changed.

8.17.2 To Replace Filter-Drier

a. Pump down the unit per section 8.9.1. Remove bracket, then replace drier. Tighten inlet side fitting.

b. Slowly open king valve and purge air through the drier. Tighten drier outlet side fitting.

c. Leak test drier connections.

d. Check refrigerant level.

e. Check unit operation by running Pretrip (Refer to Section 3.3).

8.18 THERMOSTATIC EXPANSION VALVE

⚠ CAUTION

Service mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating. Refer to Section 5.2.3.

⚠ WARNING

UNITS EQUIPPED WITH STAR-TRAK TWO WAY COMMUNICATION CAPABILITIES MAY HAVE THE ABILITY TO BE STARTED OR TURNED OFF REMOTELY REGARDLESS OF THE SETTING OF THE START/RUN-OFF SWITCH.

The unit is controlled locally and there can be no two-way communication when the mode switch on the Remote Monitoring Control Box is in MAINTENANCE MODE. Therefore, when performing any work on the unit, place the mode switch in MAINTENANCE MODE. After the unit is serviced, return the mode switch to REMOTE ON. (Refer to Section 3.19.3 for more information on two-way communication.)

The thermostatic expansion valve (TXV) is an automatic device, which maintains constant superheat of the refrigerant gas leaving the evaporator regardless of suction pressure. The valve functions are: (a) automatic response of refrigerant flow to match the evaporator load and (b) prevention of liquid refrigerant entering the compressor. Unless the valve is defective, it seldom requires any maintenance.

8.18.1 Replacing Expansion Valve & Screen

a. Pump down the unit by closing the king valve. (Refer to Section 8.9.1.)

b. Remove insulation (Presstite) from expansion valve bulb and then remove bulb from suction line.

c. Remove Presstite from the expansion valve power head. Unscrew power head only if the element is being changed and replace by reversing steps a. through c.

d. Use a wet rag to keep TXV cool whenever brazing. Heat inlet, outlet and equalizer connections to valve body and remove valve. Clean all tube stubs so new valve fits on easily.

e. Reverse steps a. through d. to install new valve and screen, with cone of screen pointing into liquid line at inlet to the valve.

f. The thermal bulb is located below the center of the suction line (See Figure 8-25). This area must be clean to ensure positive bulb contact. Firmly tighten the straps around the thermal bulb and suction line and insulate both with Presstite.

g. Evacuate by placing vacuum pump on suction service valve. Draw down to 500 microns.

h. Open king valve and then check refrigerant level. See Section 8.12.1.

i. Check unit operation by running Pretrip (Refer to Section 3.3).

8.18.2 Checking Superheat

NOTE

Do not adjust expansion valve unless absolutely necessary.

Due to the time involved in adjusting the superheat, replace the valve rather than adjusting it.

8.18.3To Measure Superheat

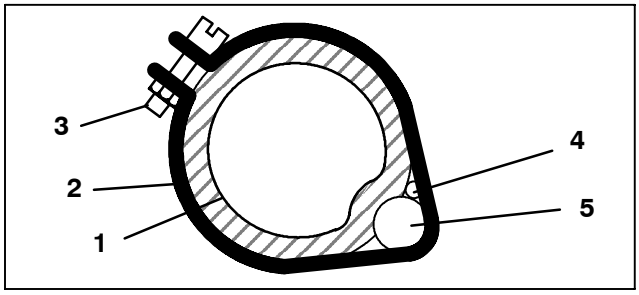
NOTE

The expansion valve and bulb location are shown in Figure 2-7.

a. Remove evaporator panel from rear of unit and then pull loose the Presstite insulation from one end of the expansion valve bulb.

b. Loosen one TXV bulb clamp and make sure area under clamp (above TXV bulb) is clean.

c. Place thermocouple above (parallel with) TXV bulb and then secure loosened clamp making sure both bulbs are firmly secured to suction line as shown in Figure 8–25. Use Presstite insulation to completely cover both bulbs.



1. Suction Line
2. TXV Bulb Clamp
3. Nut and Bolt (Clamp)
4. Thermocouple
5. TXV Bulb

Figure 8–25. Thermostatic Expansion Valve Bulb and Thermocouple

NOTE

When conducting this test the suction pressure must be at least 6 PSIG (0.41 Bar) below expansion valve maximum operating pressure (MOP). For MOP Refer to Section 2.10.

d. Connect an accurate gauge to the 1/4" (0.01mm) port on the suction service valve.

e. Run unit until stabilized. Set controller 10°F (5.5°C) below refrigerated compartment temperature.

f. From the temperature/pressure chart (Refer to Table 8-8), determine the saturation temperature corresponding to the evaporator outlet pressure.

g. Note the temperature of the suction gas at the expansion valve bulb.

h. Subtract the saturation temperature determined in Step f. from the average temperature measured in Step g. The difference is the superheat of the suction gas.

8.19 CHECKING AND REPLACING HIGH PRESSURE CUTOUT SWITCH (HPS)

8.19.1 Replacing High Pressure Switch

a. Pump down the unit. (Refer to Section 8.9.1) Frontseat both suction and discharge service valves to isolate compressor.

b. *Slowly* release compressor pressure through the service valve gauge ports.

c. Disconnect wiring from defective switch, and remove old switch. The HPS is located at the side of the center compressor cylinder head. (See Figure 8–20)

d. Install new cutout switch after verifying switch settings. (Refer to Section 8.19.2)

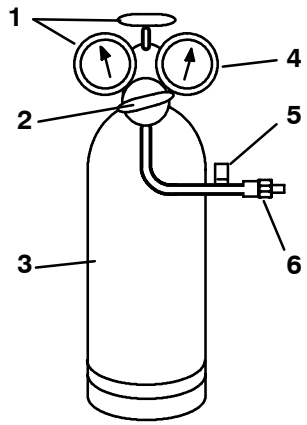
e. Evacuate and dehydrate the compressor. Draw down to 500 microns. (Refer to Section 8.11**)**

f. Check unit operation by running Pretrip (Refer to Section 3.3).

8.19.2 Checking High Pressure Switch

⚠ WARNING

Do not use a nitrogen cylinder without a pressure regulator. Cylinder pressure is approximately 2350 PSIG (159.9 Bars). Do not use oxygen in or near a refrigerant system as an explosion may occur. (See Figure 8-26)



1. Cylinder Valve and Gauge
2. Pressure Regulator
3. Nitrogen Cylinder
4. Pressure Gauge [0 to 400 PSIG (0 to 27.2 Bars)]
5. Bleed-Off Valve
6. 1/4 inch Connection

Figure 8-26. Typical Setup for Testing High Pressure Switch

a. Remove switch as outlined in Section 8.19.1.

b. Connect ohmmeter or continuity light across switch terminals. Ohmmeter will indicate resistance and continuity light will be lit if switch closes after relieving pressure.

c. Connect switch to a cylinder of dry nitrogen. (See Figure 8-26)

d. Set nitrogen pressure regulator higher than cutout point on switch being tested. Pressure switch cutout and cut-in points are shown in Section 2.10.

e. Close valve on cylinder and open bleed-off valve.

f. Open cylinder valve. Slowly close bleed-off valve and increase pressure until the switch opens. If a light is used, it will go out. If an ohmmeter is used, the meter will indicate open. Open pressure on gauge. Slowly open bleed-off valve (to decrease pressure) until switch closes. (The light will light or the ohmmeter will close.)

8.20 COMPRESSOR DISCHARGE PRESSURE TRANSDUCER (CDP)

(CTD P/N 12-00352-04 - RED)

8.20.1 Calibrating Compressor Discharge Pressure Transducer

The compressor discharge pressure transducer (CDP) has a range of 0 to 500 PSIG (0 to 34.02 Bars). With this large of a pressure range, some transducers will not read exactly the same as the next. To allow for variations in transducers, and still display an accurate pressure reading in the Data list, there is a calibration feature for the CDP built into the microprocessor.

To calibrate the CDP, it *must* be removed from the compressor, and be exposed to 0 Bar/PSIG. During the calibration process, the microprocessor measures the difference between what the transducer is sending and what the microprocessor was expecting for a zero reading. The difference between these two is called an offset. This offset is then stored in the microprocessor's memory, and is used in all future calculations for displaying compressor discharge pressure.

NOTE

The Compressor Discharge Pressure on the microprocessor Data list will never read less than 0 Bar/PSIG, even if it is exposed to a vacuum (such as when evacuating the system.) Consequently, a transducer reading of 0 does not indicate accurate calibration. Every discharge transducer *must* be calibrated before being installed into a compressor.

a. Power up the transducer circuit. Place unit into PC mode (Refer to Section 5.1), or place unit in Manual Start mode.

b. Press the Select key until "Press ↑ ↓ to View Data" appears in the MessageCenter.

c. Press the Up Arrow until "Discharge Pressure" is showing in the MessageCenter.

d. Press and hold the Equal key for six seconds. The MessageCenter will blink five times. When it stops blinking, the display will either show "Discharge Pressure: 0.0 Bar/PSIG," or the message "Calibration Unsuccessful."

e. When "Discharge Pressure: 0.0 Bar/PSIG" appears, the offset has been saved into the microprocessor memory, and the calibration is complete.

f. If the calibration was unsuccessful, either there is more than 0 Bar/PSIG on the transducer, or the transducer is further away from 0 than an offset will allow. The transducer must be replaced.

8.20.2 Testing Compressor Discharge Pressure Transducer

a. Verify that the wiring to the transducer is correct. (See wiring diagram, Section 10.)

b. Power up the transducer circuit. Place unit into PC mode (Refer to Section 5.1), or place unit in Manual Start mode.

c. Check Voltage to transducer connector. Voltage reading between A (negative) and B (positive) should be 5.0 VDC.

d. Check wire resistance between C (output to microprocessor) and 1MP5.

e. Place +5.0 VDC on transducer terminal B and -5.0 VDC on transducer terminal A. Disconnect C from the microprocessor. Test voltage between B and C. The reading should be as shown in table below.

Table 8-3. Compressor Discharge Pressure Transducer					
Bars/PSIG	**Voltage**	**Bars/PSIG**	**Voltage**	**Bars/PSIG**	**Voltage**
0/0	0.5	5.44/80	1.1	17.0/250	2.5
0.68/10	0.6	6.12/90	1.2	18.7/275	2.7
1.36/20	0.7	6.8/100	1.3	20.41/300	2.9
2.04/30	0.7	8.51/125	1.5	22.11/325	3.1
2.72/40	0.8	10.21/150	1.7	23.81/350	3.3
3.4/50	0.9	11.91/175	1.9	25.52/375	3.5
4.08/60	1.0	13.61/200	2.1	27.22/400	3.7
4.76/70	1.1	15.31/225	2.3	30.62/450	4.1

⚠ WARNING

The +5.0 VDC (terminal B) is common between the Compressor Discharge Pressure Transducer, the Compressor Suction Pressure Transducer, and the RPM sensor for non ESC engines or ENSSN for engines with electronic speed control. If this circuit is shorted to ground (due to one of the mentioned components being defective, or a worn wire) the MessageCenter will show:

- **Suction Pressure: -29.9inHg (-1 Bar)**
- **Discharge Pressure: 0 Bar/PSIG**
- **Engine RPM: 0.**

8.20.3 Replacing Compressor Discharge Pressure Transducer

a. Pump down the compressor. (Refer to Section 8.9.1.) Frontseat both suction and discharge service valves to isolate compressor.

b. Equalize compressor discharge and suction pressures through the service valve gauge set. Slowly purge off the high side pressure to 0 Bar/PSIG.

c. Disconnect wiring from defective transducer and remove. The CDP is located at the side of the center compressor cylinder head. (See Figure 8–20)

⚠ WARNING

The Compressor Discharge Pressure Transducer does not have a Schrader valve in the connecting fitting. Any discharge pressure remaining in the compressor will be released when removing the CDP.

d. Calibrate new discharge transducer before installing in compressor. (Refer to Section 8.20.1)

e. Install new discharge transducer, being careful to obtain the correct transducer for your unit. R-404A CDPs have a red dot on the side. (See Figure 8–17).

⚠ CAUTION

Service mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating. Refer to Section 5.2.3.

f. Evacuate and dehydrate the compressor. (Refer to Section 8.11.**)** Pull down to 500 microns

g. Check unit operation by running Pretrip (Refer to Section 3.3).

8.21 COMPRESSOR SUCTION PRESSURE TRANSDUCER (CSP)
(CTD P/N 12-00352-03 - BLUE)

8.21.1 Calibrating Compressor Suction Pressure Transducer

The Compressor Suction Pressure Transducer (CSP) has a range of -29.9 inHg to 100 PSIG (-1 to 6.8 Bars). Because of this much smaller range, calibration of the CSP is not required.

8.21.2 Testing Compressor Suction Pressure Transducer

a. Verify that the wiring to the transducer is correct. (See wiring diagram, Section 10).

b. Power up the transducer circuit. Place unit into PC mode (Refer to Section 5.1), or place unit in Manual Start mode.

c. Check Voltage to transducer. Voltage reading between A (negative) and B (positive) should be 5.0 VDC.

d. Check wire continuity C (output to microprocessor) and 1MP6.

e. Place +5.0 VDC on transducer terminal B and -5.0 VDC on transducer terminal A. Test voltage between B and C. The reading should be as shown in table below.

⚠ WARNING

The +5.0 VDC (terminal B) is common between the Compressor Discharge Pressure Transducer, the Compressor Suction Pressure Transducer, and the RPM sensor for non ESC engines or ENSSN for engines with electronic speed control. If this circuit is shorted to ground (due to one of the mentioned components being defective, or a worn wire) the MessageCenter will show:

- **Suction Pressure: -29.9inHg (-1 Bar)**
- **Discharge Pressure: 0 Bar/PSIG**
- **Engine RPM: 0.**

Table 8-4. Compressor Suction Pressure Transducer

PSIG/Bars	Voltage	PSIG/Bars	Voltage	PSIG/Bars	Voltage
-10/-0.68	0.7	30/2.04	2.1	70/4.76	3.5
-5/-0.34	0.8	35/2.38	2.2	75/5.1	3.6
0/0	1.0	40/2.72	2.4	80/5.44	3.8
5/0.34	1.2	45/3.06	2.6	85/5.78	4.0
10/0.68	1.4	50/3.4	2.8	90/6.12	4.1
15/1.02	1.5	55/3.74	2.9	95/6.46	4.3
20/1.36	1.7	60/4.08	3.1	100/6.8	4.5
25/1.7	1.9	65/4.42	3.3		

8.21.3 Replacing Compressor Suction Pressure Transducer

⚠ WARNING

UNITS EQUIPPED WITH STAR-TRAK TWO WAY COMMUNICATION CAPABILITIES MAY HAVE THE ABILITY TO BE STARTED OR TURNED OFF REMOTELY REGARDLESS OF THE SETTING OF THE START/RUN-OFF SWITCH.

The unit is controlled locally and there can be no two-way communication when the mode switch on the Remote Monitoring Control Box is in MAINTENANCE MODE. Therefore, when performing any work on the unit, place the mode switch in MAINTENANCE MODE. After the unit is serviced, return the mode switch to REMOTE ON. (Refer to Section 3.19.3 for more information on two-way communication.)

a. Pump down the unit (at the king valve) until the suction pressure is approximately 5 PSIG (0.34 Bar). (Refer to Section 8.9.1.)

b. Disconnect wiring from defective transducer. Slowly remove the transducer. The pressure remaining in the suction line will be held in place by a Schrader valve located inside the fitting. The CSP is located on the suction line just above the suction service valve. (See Figure 2-4).

c. Install new suction transducer, being careful to obtain the correct transducer for your unit. R-404A CSPs have a blue dot on the side. Check for leaks.

d. Open the king valve and check operation.

⚠ CAUTION

Service mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating.

e. Evacuate and dehydrate the compressor. (Refer to Section 8.11.**)**

f. Check unit operation by running Pretrip (Refer to Section 3.3).

8.22 REPLACING RECEIVER SIGHT GLASS ASSEMBLY OR FUSIBLE PLUG

⚠ CAUTION

Service mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating.

a. Store the refrigerant in an evacuated container. (Refer to Section 8.9.1.)

b. Unscrew the sight glass assembly. Wrap threads with Teflon tape or spread some sealing compound on pipe threads of new sight glass assembly or plug and install. The torque value for either the sight glass assembly or the plug is 20-25 ft-lbs (2.8 to 3.5 Mkg)

c. Leak check receiver sight glass or fusible plug per Section 8.10.

d. After leak checking unit, evacuate and dehydrate as outlined in Section 8.10.

e. Add refrigerant charge. (Refer to Section 8.12)

Checking For Noncondensibles

To check for noncondensibles, proceed as follows:

1 Stabilize system to equalize pressure between the suction and discharge side of the system. The engine needs to be off for several hours.

2 Measure temperature at any of the copper tubing in the condenser.

3 Check pressure at the compressor discharge service valve.

4 Determine saturation pressure as it corresponds to the condenser temperature using the Temperature-Pressure Chart, Table 8-8.

5 If gauge reading is 3 psig (0.2 BAR) or higher than the calculated P/T pressure in step 4, noncondensibles are present.

6 Remove refrigerant using a refrigerant recovery system. (Refer to Section 8.9)

7 Evacuate and dehydrate the system. (Refer to Section 8.11)

8 Charge the unit. (Refer to Section 8.12)

8.23 SERVICING SOLENOID VALVES

8.23.1 Solenoid Valve - SV2/SV4

⚠ CAUTION

Do not over tighten or damage the enclosing tube assembly. Torque to 17-ft pounds (2.4 Mkg). Also make sure all parts are placed on the enclosing tube in proper sequence to avoid premature coil burnout.

a. Replacing the Coil

NOTE

The coil may be replaced without removing the refrigerant or pumping the unit down.

1. Unplug from wiring harness, remove coil retainer and coil assembly.
2. Verify coil type, voltage and frequency. This information appears on the coil housing.
3. Place new coil over enclosing tube, retainer and connect wiring.

b. Replacing solenoid valve internal parts

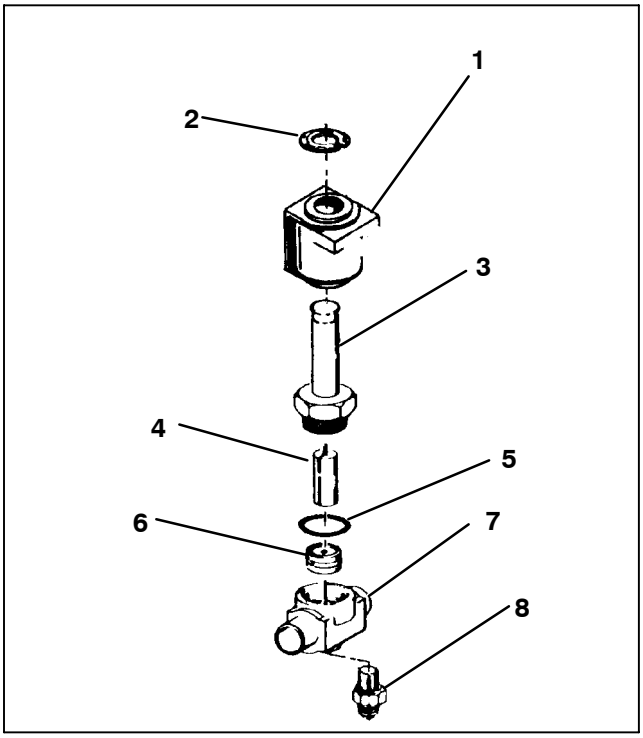
⚠ WARNING

UNITS EQUIPPED WITH STAR-TRAK TWO WAY COMMUNICATION CAPABILITIES MAY HAVE THE ABILITY TO BE STARTED OR TURNED OFF REMOTELY REGARDLESS OF THE SETTING OF THE START/RUN-OFF SWITCH.

The unit is controlled locally and there can be no two-way communication when the mode switch on the Remote Monitoring Control Box is in MAINTENANCE MODE. Therefore, when performing any work on the unit, place the mode switch in MAINTENANCE MODE. After the unit is serviced, return the mode switch to REMOTE ON. (Refer to Section 3.19.3 for more information on two-way communication.)

⚠ CAUTION

Service mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating.



1. Coil Assembly
2. Retainer
3. Enclosing Tube Assy
4. Plunger Assy
5. Seal
6. Piston Assy
7. Body
8. Bracket Adapter

Figure 8-27. SV2/SV4 Solenoid Valves

To service the liquid line solenoid valve (SV–2) or the hot gas solenoid valve (SV–4) first pump the unit down. (Refer to Section 8.9.1.)

Remove and store the refrigerant charge in an evacuated container. (Refer to Section 8.9.2.)

1. Remove coil retainer and coil assembly from valve. Remove enclosing tube assembly and related items.
2. Check for foreign material in valve body.
3. Install new parts.

NOTE

Rebuild kit (P/N 14-00150-51) contains both a black neoprene seal and a white Teflon seal. Use the one that matches seal in existing valve. The valve with the Teflon seal can be identified by two dimples in the housing. (See Figure 8–28)

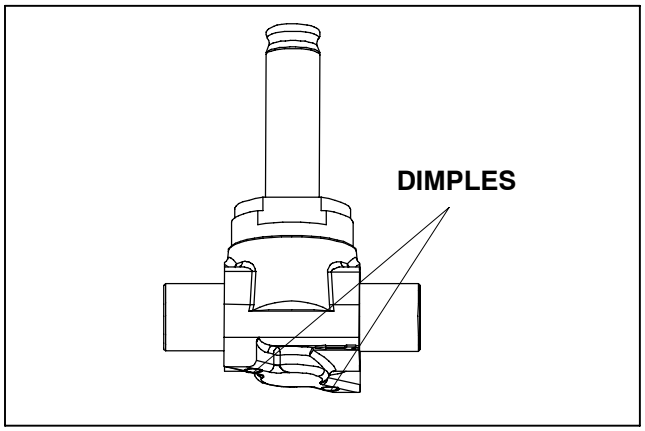


Figure 8–28. SV-2/SV-4 MARKING

4. Tighten enclosing tube assembly to a torque value of 17 ft pounds (2.4 Mkg) and leak check the valve. (Refer to Section 8.10)
5. Install coil assembly and retainer.
6. Start unit and check refrigerant charge (Refer to Section 8.12.)
7. Check refrigeration cycles.
8. Run Pretrip. (Refer to Section 3.3)

8.23.2 Solenoid Valve – SV1

a. Replacing the Coil

NOTE

The coil may be replaced without removing the refrigerant or pumping the unit down.

1. Remove top locknut, spacer cup and nameplate.
2. Disconnect wiring and remove coil.
3. Replace coil by reversing steps 1 and 2.

b. Replacing Internal Components (See Figure 8–29)

⚠ CAUTION

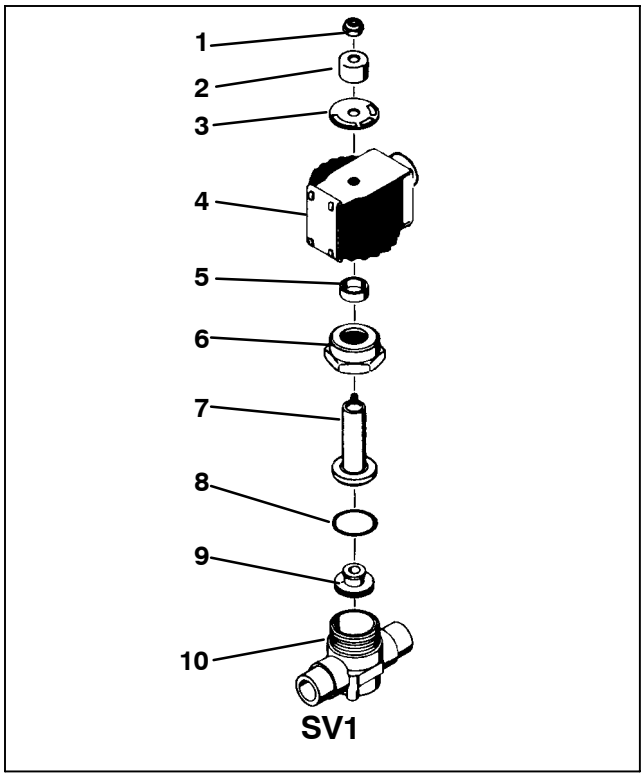
Service mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating.

⚠ WARNING

UNITS EQUIPPED WITH STAR-TRAK TWO WAY COMMUNICATION CAPABILITIES MAY HAVE THE ABILITY TO BE STARTED OR TURNED OFF REMOTELY EVEN IF THE START/RUN-OFF SWITCH IS IN THE OFF POSITION.

The unit is controlled locally and there can be no two-way communication when the mode switch on the Remote Monitoring Control Box is in MAINTENANCE MODE. Therefore, when performing any work on the unit, place the mode switch in MAINTENANCE MODE. After the unit is serviced, return the mode switch to REMOTE ON. (Refer to Section 3.19.3 for more information on two-way communication.)

1. Remove and store the refrigerant charge in an evacuated container. (Refer to Section 8.9.2.)
2. Remove the top locknut, spacer cup, nameplate, coil assembly and spacer.
3. Using a 12 point, 1-3/8 inch box wrench, loosen the enclosing tube locknut and bleed off remaining refrigerant.
4. Remove enclosing tube and locknut assembly. The gasket is inside the enclosing tube.
5. Remove seat disc from inside of body and check for obstructions and foreign material.
6. Place the seat disc into the valve body with the smaller diameter end facing up.
7. Place the enclosing tube locknut over the enclosing tube. Install spacer over enclosing tube making sure it is seated properly in the enclosing tube locknut. Tighten enclosing tube locknut to a torque value of 20 ft-lb (2.78 Mkg). Do not over tighten.
8. Install coil assembly, nameplate and top locknut or screw.
9. Dehydrate and evacuate the system. (Refer to section 8.11) Charge unit with refrigerant per sections 8.12.
10. Start unit and check operation.
11. Run Pretrip. (Refer to Section 3.3)



1. Locknut/Screw
2. Spacer Cup
3. Nameplate
4. Coil
5. Spacer
6. Enclosing Tube Lock nut
7. Enclosing Tube
8. Seal
9. Seat Disc
10. Body

Figure 8-29. SV1 Solenoid Valve

Solenoid Valve SV1 Checkout Procedure

To obtain proper heating and defrost, the normally open (N.O.) SV1 solenoid valve must energize and close tightly during the heat and defrost cycles. If the valve does not close tightly due to physical damage, foreign material or wear, refrigerant leakage through the valve can reduce heating capacity.

During normal heat or defrost cycles the following conditions will be observed when the valve is operating properly:

a. Receiver refrigerant level will drop quickly at the initiation of heating or defrost mode.

b. Suction pressure will rise slowly to 90-100 PSIG (6.12 to 6.80 Bar).

c. Discharge pressure will drop quickly, but will begin to rise to a minimum of 250 PSIG (17.0 Bars) within 15 to 20 minutes.

If suction and discharge pressures remain low and the receiver level does not drop, the valve may be inoperative and can be checked by the following method.

a. Verify the solenoid coil has proper voltage and is energized in heating and defrosting.

b. Connect a discharge pressure gauge to the compressor discharge service valve and connect a gauge to the manual shut-off valve (king valve) leaving the receiver tank.

c. With the refrigerated compartment temperature at 35°F (1.7°C) or lower, operate the unit in high speed cool and remove or disconnect the “GND” wire leading to the SV1 coil.

d. With a separate 12 VDC negative ground wire, energize SV1 with the unit in high speed cooling and observe the discharge and receiver pressures. If the valve is closing properly, compressor discharge pressure will begin to rise and the receiver pressure will remain the same or begin to drop slowly. If the valve is not seating properly, both discharge and receiver pressure will rise slowly or remain the same.

Operate the unit until discharge pressure reaches 200 PSIG (13.61 Bars) and disconnect jumper wire to SV1 valve. Discharge and receiver pressure should be within 5 to 15PSIG (0.34 to 1.02 Bars) of each other.

8.24 COMPRESSOR SUCTION MODULATION VALVE (CSMV)

The purpose of the CSMV is to control suction pressure, maintain the compressor within its operating envelope, and maximize unit capacity and fuel economy.

At initial startup, the microprocessor will go through a self test. When the test is complete, the MessageCenter will display “SMV CLOSING.” The process of fully closing the CSMV on startup is known as “homing” the CSMV. When homing is complete, the MessageCenter will display “SETTING SMV XX%.” The XX% will count up to a predetermined percentage depending on ambient temperature and refrigerated compartment temperature. The unit will then go through its normal start procedure.

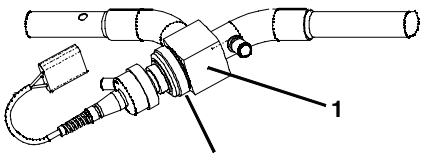


Figure 8-30. Compressor Suction Modulation Valve (CSMV)

The CSMV coil consists of two windings labeled 1 and 2. Each winding has two poles, labeled A and B.

Both poles of both windings have a wire connected back to the micro.

Looking at the 4-pin connector on the CSMV coil, the wiring is as follows:

Table 8-5. CSMV Connections		
Connector Pin	**Wire Color**	**Winding/-Pole**
A	BLACK	1A
B	WHITE	1B
C	RED	2B
D	GREEN	2A

Each winding has a resistance of about 75 Ω.

There is no common connection point between the two windings.

The reason this coil design is bipolar is that the microprocessor causes the valve to open by energizing the windings in a particular sequence *and* by reversing the polarity of the current through the windings in a specific sequence.

Energizing the windings with the correct polarity, in the correct sequence, rotates the rotor and causes the valve to open one step.

The windings are energized and polarized in the reverse sequence to close the valve one step.

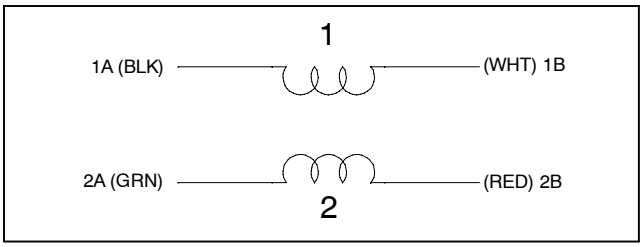


Figure 8-31. CSMV Coil (Bi-Polar Design)

8.24.1 CSMV Diagnostics

If the CSMV is suspected to be faulty, the first thing the operator should do is perform a unit Pretrip (Refer to Section 3.3). Some symptoms that could indicate a faulty CSMV are:

- Unusually high suction pressure in COOL mode.
- A27 – High Suction Pressure alarm may be generated.
- Unusually low suction pressure
- A18 – Low Refrigerant alarm may be generated
- Poor temperature control
- Refrigerated compartment temperature deviates from setpoint.

If the unit fails Test 10 during pretrip, (P180 CHECK SUCTION MOD VALVE), the CSMV could be faulty. The CSMV could have become mechanically jammed, or it could have failed electrically in the power head, or it may not be receiving the proper signal from the micro. There are several steps the operator should make in addition to the unit Pretrip to further diagnose the valve.

a. The CSMV may be stuck in some position other than completely closed and the stepper motor cannot move the piston. To check if the valve is stuck, first start the unit and run in cool mode with manifold gauges attached to the compressor

b. Unplug SV2 coil and allow the suction pressure to pull down to 0 Bar/PSIG.

⚠ WARNING

Carrier Transicold does not recommend allowing the compressor to pull less than 0 Bar/PSIG at any time.

c. Once the unit has reached suction pressure of 0 Bar/-PSIG, switch the unit to OFF using the START/RUN--OFF switch. After the engine shuts down, the microprocessor will fully close the CSMV.

NOTE

Carefully listen to the valve. When the unit is off and the valve is closing, the valve will make a ratcheting noise that may be heard or felt as it is closing. If this can be heard or felt, it indicates that the microprocessor is **attempting** to close the valve, and may serve as a quick indication that the drive module is in working order. It is not, however, an indication that the valve piston is actually working.

d. Wait about two minutes after the engine stops to ensure the valve is fully shut and then energize SV2 with 12 VDC manually.

e. If the CSMV is fully shut, the suction pressure should still read 0 Bar/PSIG after energizing SV2. If the valve is stuck at some position other than fully closed, or it cannot fully close for any reason, the suction pressure during this test will rise.

1. If the suction pressure holds to 0, go to Step f.
2. If the suction pressure rises, go to Step g.

f. Use the Stepper Motor Tester (CTD special tool P/N 07-00375-00) to manually open the valve. The suction pressure on the manifold gauge should go up. If the suction pressure does not go up, the CSMV is stuck closed (go to Step g.) or there is something obstructing the refrigerant between the SV2 valve and the CSMV.

NOTE

Opening the valve can also be accomplished by using the microprocessor. To open the CSMV valve, reconnect SV2 to the engine harness. Place the START/RUN-OFF switch in the START/RUN position. The microprocessor will go through its self test and the display will show "SMV CLOSING." *The valve is obviously closed at this point, but the microprocessor still has to "home" the CSMV valve every time the microprocessor is powered up.* The display will then show "SETTING SMV XX%." Refer to 8.24 above. If the suction pressure does not go up, the CSMV is stuck closed (go to Step g.) or there is something obstructing the refrigerant between the SV2 valve and the CSMV.

NOTE

If the valve passes steps a. through f., the valve is operating properly.

g. If the suction pressure rises during Step e., or if the valve is determined to be stuck closed in Step f., turn the unit Off by placing the START/RUN-OFF switch in the OFF position and unplug the 4-pin connector to the CSMV. With a reliable digital ohmmeter, check the winding resistance between 1A (black) wire and the 1B (white) wire AND between the 2A (green) wire and the 2B (red) wire. In normal ambient, each winding should have 72 to 84 ohms. If this resistance is confirmed, proceed to Step 8. If an infinite or zero ohm reading occurs, first check the wires at the connector for good contact. If the connector is in good condition and the resistance is still bad, one (or both) of the coils could be faulty. Replace the CSMV power head assembly. Refer to Section 8.24.2.

h. Locate the wires on the engine harness side of the CSMV connector. Locate the wires labeled CSMVA, CSMVB, CSMVC and CSMVD. These will correlate to the connector pins labeled A, B, C and D. See Table 8-5.

i. Place the START/RUN-OFF switch in the START/-RUN position. DO NOT ALLOW THE UNIT TO START. When the MessageCenter displays "SMV CLOSING," measure the AC voltage between pins A and B and then between C and D. A reading of 10 to 16 VAC should be read by the digital voltmeter for each pair of wires. If this test passes, there is a good signal coming from the microprocessor.

j. If the reading of 10 to 16 VAC is not present on one or both of the wire pairs, check the wiring between the microprocessor and the CSMV connector, or check the microprocessor for proper model number configuration.

k. If all the above tests pass, the CSMV is operating properly and the abnormal unit operation can be contributed to something other than the CSMV.

8.24.2 Replacing The CSMV Power Head (14-00263-20)

a. Pump the unit down at the king valve (Refer to Section 8.9.1).

b. Unplug the CSMV connector from the engine harness.

c. Loosen the 2 1/8" nut on the CSMV and remove the power head assembly. (See Figure 8–30).

d. Install the new CSMV power head.

e. The power head should be set to 100% (Open) when received from the warehouse. This is to ensure the Teflon valve seal is not damaged when it is installed. Ensure the valve is fully open by using stepper motor tester (CTD special tool P/N 07-00375-00) to manually open the valve to 100% before it is installed.

f. Torque the 2 1/8" nut to 35 to 40 ft-lbs (4.8 to 5.5 Mkg)

g. Reconnect the CSMV connector to the engine harness.

⚠ CAUTION

Service mode MUST be used whenever removing refrigerant charge, refrigerant leak checking or evacuating.

h. Evacuate the low side of the refrigeration system. (Refer to Section 8.11)

i. Open the king valve, run the unit for approximately 10 minutes and initiate a pretrip.

8.25 CHECKING DEFROST OR HEATING CYCLE

NOTE

DTT2 must be 40°F (4.4°C) or lower, before any checks can be made.

8.25.1 Hot Gas Solenoid Valve (SV1 & SV4) Heating and Defrosting

a. Connect a discharge pressure gauge to the manual shut-off valve (king valve) and another gauge to the compressor discharge service valve. Connect a gauge to the compressor suction service valve.

b. Start unit with controller set at least 10°F (5.5°C) below indicated refrigerated compartment temperature to obtain high speed cooling. Press the MANUAL DEFROST key to initiate defrost. (DTT2 must be at or below 40°F (4.4°C). The hot gas solenoid valve (SV4) will energize and the hot gas line will be hot to touch on both sides of the valve. The condenser pressure control solenoid (SV1) closes and suction pressure will rise approximately 10 to 15 PSIG (0.68 to1.02 Bars) after five minutes on unit operation. Refer to Section 8.23.2 if unit does not heat properly.

c. Unit should remain in defrost until DTT2 (located on the center tube sheet below the evaporator) reaches 55°F (12.8°C). At this point the defrost cycle will terminate and the unit will resume automatic operation.

8.25.2 Defrost Air Switch (DAS)

a. To check the Defrost Air switch, run unit in high speed cooling and place a jumper across the air switch terminals. This will start the defrost cycle as it simulates the action of the defrost air switch. Bypassing the switch in this manner operates all components involved in defrost.

NOTE

If DTT2 is above 40°F (4.4°C), the MessageCenter will show "CANNOT START DEFROST CYCLE."

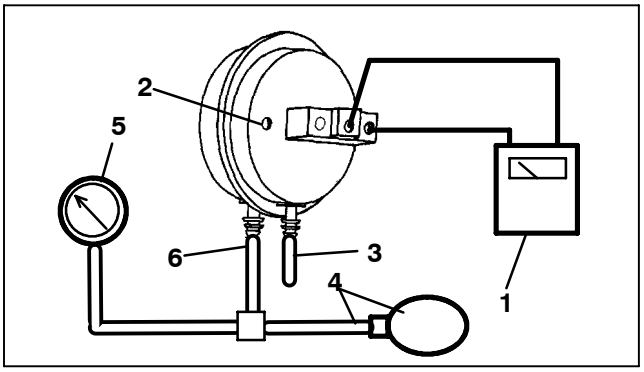
b. Unit should remain in defrost until DTT2 reaches 55°F (12.8°C). At this point the defrost cycle will terminate, and the unit will resume automatic operation.

c. If the above test indicates satisfactory operation, test Defrost Air switch (DAS) settings using a magnehelic gauge. (Refer to Section 8.26)

8.25.3 Electronic Defrost Timer

Refer to Section 4.4.8 for description.

8.26 CHECKING CALIBRATION OF DEFROST AIR SWITCH



1. Ohmmeter or Continuity Device
2. Adjustment Screw (0.050" socket head size)
3. Low Side Connection
4. Pressure Line or Aspirator Bulb (P/N 07-00177-01)
5. Magnehelic Gauge (P/N 07-00177-00)
6. High Side Connection

Figure 8-32. Defrost Air Switch Test Setup

a. Make sure magnehelic gauge is in proper calibration.

NOTE

The magnehelic gauge may be used in any position, but must be re-zeroed if position of gauge is changed from vertical to horizontal or vice versa. USE ONLY IN POSITION FOR WHICH IT IS CALIBRATED.

The Defrost Air switch MUST be in the same orientation as it will be in when installed in the unit.

b. With air switch in vertical position, connect high pressure side of magnehelic gauge to high side connection of air switch. (See Figure 8-32)

c. Install tee in pressure line to high side connection. Tee should be approximately halfway between gauge and air switch or an improper reading may result.

d. Attach an ohmmeter to the air switch electrical contacts to check switch action.

NOTE

Use a hand aspirator (P/N 07-00177-01), since blowing into tube by mouth may cause an incorrect reading.

e. With the gauge reading at zero, apply air pressure very slowly to the air switch. An ohmmeter will indicate continuity when switch actuates. The switch contacts should close and the ohmmeter needle move rapidly to 0. Any hesitation in the ohmmeter indicates a possible problem with the switch, and it should be replaced.

f. Refer to Section 2.10 for switch settings. If switch fails to actuate at correct gauge reading, adjust switch by turning adjusting screw clockwise to increase setting or counterclockwise to decrease setting.

g. Repeat checkout procedure until switch actuates at correct gauge reading.

h. After switch is adjusted, place a small amount of paint or fingernail polish on the adjusting screw so that vibration will not change switch setting.

8.27 EVAPORATOR COIL CLEANING

The use of recycled cardboard cartons is increasing across the country. The recycled cardboard cartons create much more fiber dust during transport than “new” cartons. The fiber dust and particles are drawn into the evaporator where they lodge between the evaporator fins. If the coil is not cleaned on a regular basis, sometimes as often as after each trip, the accumulation can be great enough to restrict air flow, cause coil icing, repetitive defrosts and loss of unit capacity. Due to the “washing” action of normal defrost the fiber dust and particles may not be visible on the face of the coil but may accumulate deep within.

Clean the evaporator coil on a regular basis, not only to remove cardboard dust, but also to remove any grease or oil film, which sometimes coats the fins and prevents water from draining into the drain pan.

Cardboard fiber particles after being wetted and dried several times can be very hard to remove. Therefore, several washings may be necessary.

a. Remove rubber check valves (Kazoo) from drain lines (front of refrigerated compartment).
b. Remove evaporator bulkhead and back panel, then spray coil with a mild detergent solution such as Oakite 164 or any good commercial grade automatic dish washer detergent such as Electrosol or Cascade and let the solution stand for a few minutes and reverse flush (opposite normal air flow) with clean water at mild pressure. A garden hose with spray nozzle is usually sufficient. Make sure drain lines are clean.
c. Replace evaporator back panel and run unit until defrost mode can be initiated to check for proper draining from drain pan.

8.28 CONDENSER COIL CLEANING

Remove all foreign material from the condenser coil by reversing the normal air flow. (Air is pulled in through the front and discharges over the engine.) Use an FDA approved cleaning agent whenever possible. However, compressed air or water may be used as a cleaning agent. It may be necessary to use warm water mixed with any good commercial dishwasher detergent. Rinse coil with fresh water if a detergent is used.

8.29 CONTROLLER SENSOR CHECKOUT

An accurate ohmmeter must be used to check resistance values shown in Table 8-6.

Due to variations and inaccuracies in ohmmeters, thermometers or other test equipment, a reading within 2% of the chart value would indicate a good sensor. If a sensor is bad, the resistance reading will usually be much higher or lower than the resistance values given in Table 8-6.

At least one lead from the sensor must be disconnected from the unit electrical system before any reading is taken. Not doing so will result in a false reading. Two preferred methods of determining the actual test temperature at the sensor, is an ice bath at 32°F (0°C) or a calibrated temperature tester.

Table 8-6. Sensor Resistance (ENCT, RAT, SAT, ATT, DTT2)												
°F	°C	Ohms	°F	°C	Ohms	°F	°C	Ohms	°F	°C	Ohms
-40	-40	336,500	18	-7.8	49,060	76	24.4	10,250	134	56.7	2,809
-38	-38.9	312,600	20	-6.7	46,230	78	25.6	9,760	136	57.8	2,697
-36	-37.8	290,600	22	-5.6	43,580	80	26.7	9,299	138	58.9	2,590
-34	-36.7	270,300	24	-4.4	41,100	82	27.8	8,862	140	60.0	2,488
-32	-35.6	251,500	26	-3.3	38,780	84	28.9	8,449	142	61.1	2,390
-30	-34.4	234,200	28	-2.2	36,600	86	30.0	8,057	144	62.2	2,297
-28	-33.3	218,200	30	-1.1	34,560	88	31.1	7,686	146	63.3	2,208
-26	-32.2	203,400	32	0	32,650	90	32.2	7,334	148	64.4	2,124
-24	-31.1	189,700	34	1.1	30,850	92	33.3	7,000	150	65.6	2,042
-22	-30	177,000	36	2.2	29,170	94	34.4	6,684	155	68.3	1,855
-20	-28.9	165,200	38	3.3	27,590	96	35.6	6,384	160	71.1	1,687
-18	-27.8	154,300	40	4.4	26,100	98	36.7	6,099	165	73.9	1,537
-16	-26.7	144,200	42	5.5	24,700	100	37.8	5,828	170	76.7	1,402
-14	-25.6	134,800	44	6.6	23,390	102	38.9	5,571	175	79.4	1,281
-12	-24.4	126,100	46	7.7	22,160	104	40.0	5,327	180	82.2	1,171
-10	-23.3	118,100	48	8.9	20,990	106	41.1	5,095	185	85.0	1,072
-8	-22.2	110,500	50	10	19,900	108	42.2	4,874	190	87.8	983
-6	-21.1	103,600	52	11.1	18,870	110	43.3	4,665	195	90.6	902
-4	-20	97,070	54	12.2	17,900	112	44.4	4,465	200	93.3	829
-2	-18.9	91,030	56	13.3	16,980	114	45.5	4,275	205	96.1	762
0	-17.8	85,400	58	14.4	16,120	116	46.7	4,095	210	98.9	702
2	-16.7	80,160	60	15.5	15,310	118	47.8	3,923	215	101.7	647
4	-15.6	75,270	62	16.6	14,540	120	48.9	3,759	220	104.4	598
6	-14.4	70,720	64	17.7	13,820	122	50.0	3,603	225	107.2	553
8	-13.3	66,460	66	18.9	13,130	124	51.1	3,454	230	110.0	511
10	-12.2	62,500	68	20.0	12,490	126	52.2	3,313	235	112.8	473
12	-11.1	58,790	70	21.1	11,880	128	53.3	3,177	240	115.6	438
14	-10.0	55,330	72	22.2	11,310	130	54.4	3,049	245	118.3	406
16	-8.9	52,090	74	23.3	10,760	132	55.6	2,926	250	121.1	378

Table 8-7. Sensor Resistance (CDT)														
°F	°C	Ohms	°F	°C	Ohms	°F	°C	Ohms	°F	°C	Ohms	°F	°C	Ohms
-40	-40	3,360,000	18	-7.8	189,690	76	24.4	102,460	134	56.7	28,160	260	126.7	3,290
-38	-38.9	3,121,020	20	-6.7	461,170	78	25.6	97,600	136	57.8	27,040	270	132.2	2,850
-36	-37.8	2,900,710	22	-5.6	434,790	80	26.7	92,990	138	58.9	25,970	280	137.8	2,490
-34	-36.7	2,697,500	24	-4.4	410,080	82	27.8	88,630	140	60.0	24,960	290	143.3	2,170
-32	-35.6	2,509,940	26	-3.3	386,940	84	28.9	84,510	142	61.1	23,980	300	148.9	1,910
-30	-34.4	2,336,720	28	-2.2	365,260	86	30.0	80,600	144	62.2	23,050	310	154.4	1,680
-28	-33.3	2,186,670	3	-1.1	344,930	88	31.1	76,890	146	63.3	22,160	320	160.0	1,480
-26	-32.2	2,028,680	32	0	325,860	90	32.2	73,380	148	64.4	21,310	330	165.5	1,310
-24	-31.1	1,891,780	34	1.1	307,970	92	33.3	70,040	150	65.6	20,500	340	171.1	1,160
-22	-30	1,765,060	36	2.2	291,180	94	34.4	66,880	155	68.3	18,980	350	176.7	1,040
-20	-28.9	1,647,700	38	3.3	275,410	96	35.6	63,880	160	71.1	16,940	360	182.2	920
-18	-27.8	1,538,950	40	4.4	260,590	98	36.7	61,040	165	73.9	15,450	370	187.8	830
-16	-26.7	1,438,120	42	5.5	246,670	100	37.8	58,330	170	76.7	14,070	380	193.3	740
-14	-25.6	1,344,580	44	6.6	233,570	102	38.9	55,770	175	79.4	12,870	390	198.9	670
-12	-24.4	1,257,770	46	7.7	221,260	104	40.0	53,330	180	82.2	11,750	400	204.4	600
-10	-23.3	1,177,150	48	8.9	209,670	106	41.1	51,010	185	85.0	10,750	410	210.0	540
-8	-22.2	1,102,240	50	10	198,760	108	42.2	48,800	190	87.8	9,870	420	215.6	490
-6	-21.1	1,032,600	52	11.1	188,490	110	43.3	46,710	195	90.6	9,050	430	221.1	450
-4	-20	967,830	54	12.2	178,820	112	44.4	44,710	200	93.3	8,320	440	226.7	410
-2	-18.9	907,560	56	13.3	169,700	114	45.5	42,820	205	96.1	7,650	450	232.2	370
0	-17.8	851,450	58	14.4	161,100	116	46.7	41,010	210	98.9	7,050	460	237.8	340
2	-16.7	799,180	60	15.5	152,990	118	47.8	39,290	215	101.7	6,510	470	243.3	310
4	-15.6	750,470	62	16.6	145,340	120	48.9	37,660	220	104.4	6,000	480	248.9	280
6	-14.4	705,060	64	17.7	138,120	122	50.0	36,100	225	107.2	5,540	490	254.4	260
8	-13.3	662,690	66	18.9	131,310	124	51.1	34,610	230	110.0	5,130	500	260.0	240
10	-12.2	623,150	68	20.0	124,870	126	52.2	33,200	235	112.8	4,760			
12	-11.1	586,230	70	21.1	118,790	128	53.3	31,850	240	115.6	4,410			
14	-10.0	551,740	72	22.2	113,040	130	54.4	30,560	245	118.3	4,090			
16	-8.9	519,500	74	23.3	107,600	132	55.6	29,330	250	121.1	3,800			

8.30 UNIDRIVE TORQUE REQUIREMENTS (FIGURE 8-33)

Extensive damage may occur if the proper hardware and procedures are not followed. Periodic inspection of hardware and bolt torque is recommended to insure the integrity of the unidrive.

NOTE

Thread locking sealant, 5/16 flat washer and 5/16 lock washer *must* be used on bolts between the compressor mounting flange and the engine bell housing. The recommended sealant is Loctite Threadlocker 262.

The following figures show the torque value, size and grade of the hardware to be used when reassembling the unidrive assembly.

8.30.1 Drive Gear

When installing a nylon drive gear always:

a. Install with black dot facing steel gear.

b. Use new bolts and locking tabs included in drive gear kit.

c. Use Loctite or a similar thread locking compound on threads of drive gear bolts.

d. DO NOT use Never-Seez or any other lubricating compound on the nylon drive gear or compressor steel gear. The gear must be assembled dry.

e. Torque the (6 bolt) nylon drive gear bolts to 30 ft-lbs.

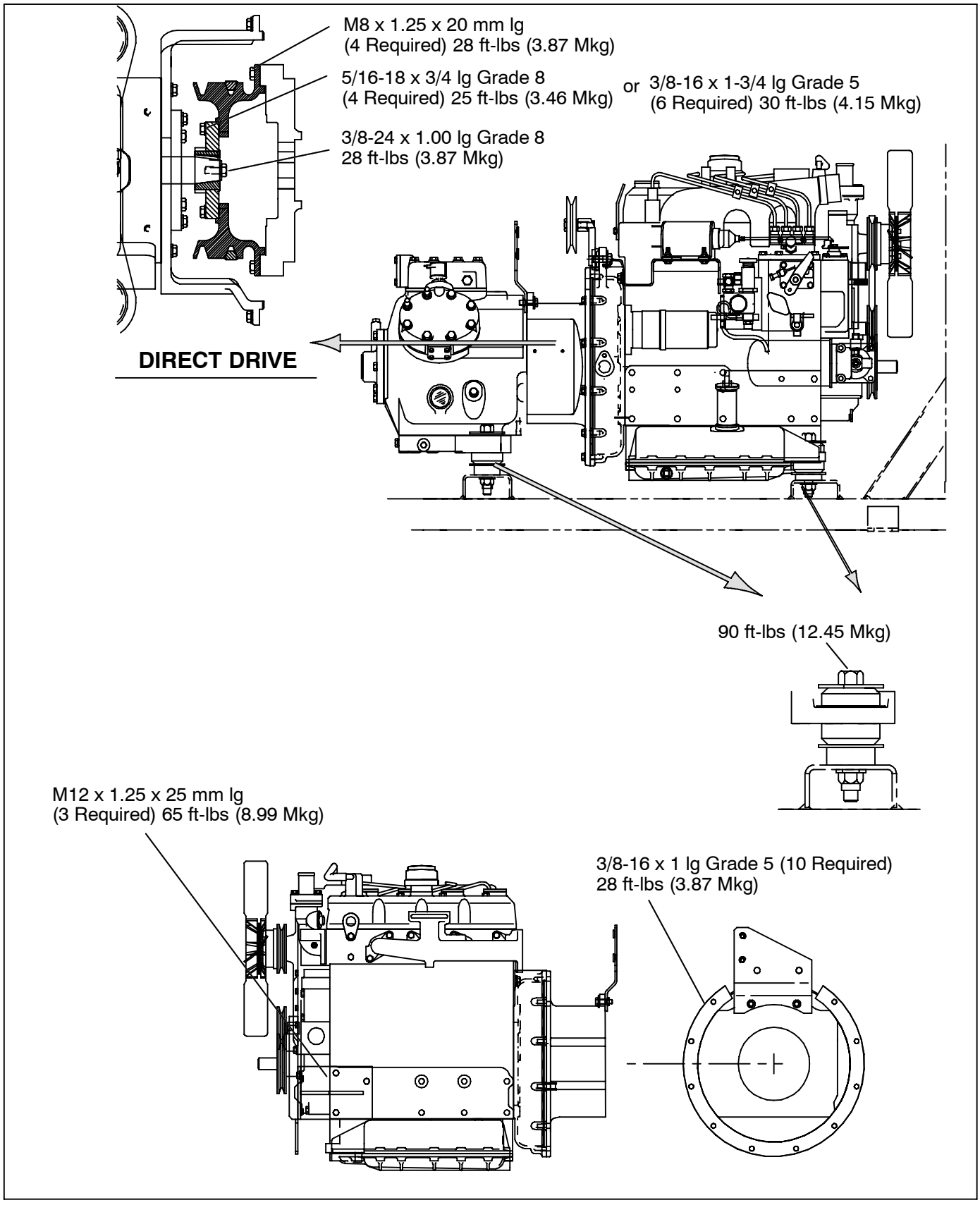

M8 x 1.25 x 20 mm lg
(4 Required) 28 ft-lbs (3.87 Mkg)
5/16-18 x 3/4 lg Grade 8
(4 Required) 25 ft-lbs (3.46 Mkg)
or 3/8-16 x 1-3/4 lg Grade 5
(6 Required) 30 ft-lbs (4.15 Mkg)
3/8-24 x 1.00 lg Grade 8
28 ft-lbs (3.87 Mkg)
DIRECT DRIVE
90 ft-lbs (12.45 Mkg)
M12 x 1.25 x 25 mm lg
(3 Required) 65 ft-lbs (8.99 Mkg)
3/8-16 x 1 lg Grade 5 (10 Required)
28 ft-lbs (3.87 Mkg)

Figure 8–33. Unidrive Torque Requirements – Non ESC Engine

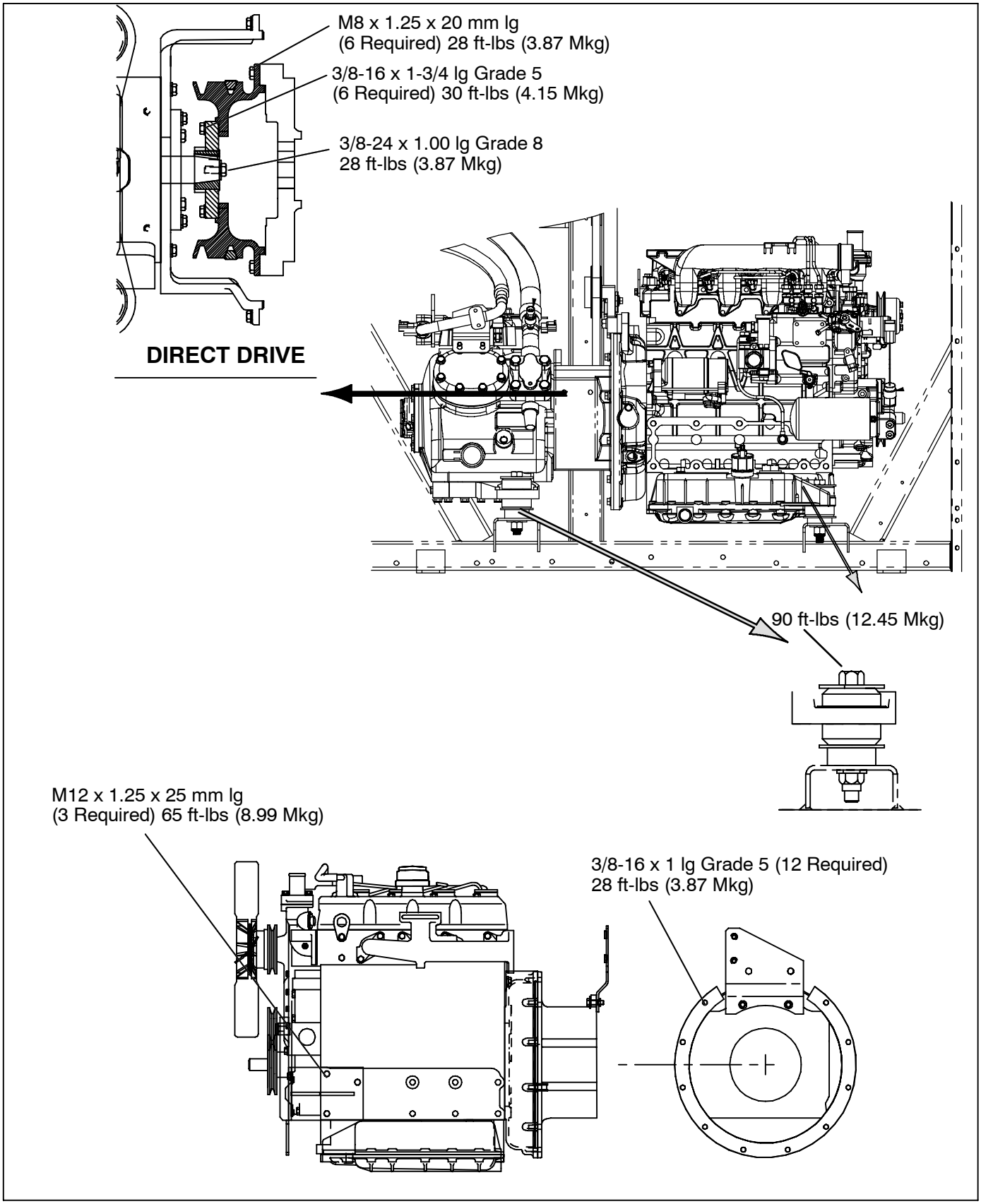

M8 x 1.25 x 20 mm lg
(6 Required) 28 ft-lbs (3.87 Mkg)
3/8-16 x 1-3/4 lg Grade 5
(6 Required) 30 ft-lbs (4.15 Mkg)
3/8-24 x 1.00 lg Grade 8
28 ft-lbs (3.87 Mkg)
DIRECT DRIVE
90 ft-lbs (12.45 Mkg)
M12 x 1.25 x 25 mm lg
(3 Required) 65 ft-lbs (8.99 Mkg)
3/8-16 x 1 lg Grade 5 (12 Required)
28 ft-lbs (3.87 Mkg)

Figure 8-34. Unidrive Torque Requirements - Electronic Speed Control Engine

Table 8-8. R-404A Temperature-Pressure Chart

Temperature		Pressure			Temperature		Pressure	
°C	°F	Bars	PSIG		°C	°F	Bars	PSIG
-40	-40	0.31	4.5		0	32	5.00	72.5
-37	-35	0.49	7.1		1	34	5.21	75.6
-34	-30	0.68	9.9		2	36	5.43	78.8
-32	-25	0.89	12.9		3	38	5.66	82.1
-29	-20	1.12	16.3		4	40	5.90	85.5
-28	-18	1.22	17.7		6	42	6.14	89.0
-27	-16	1.32	19.2		7	44	6.38	92.5
-26	-14	1.43	20.7		8	46	6.63	96.2
-24	-12	1.54	22.3		9	48	6.89	99.9
-23	-10	1.65	23.9		10	50	7.15	103.7
-22	-8	1.77	25.6		13	55	7.96	115.4
-21	-6	1.88	27.3		16	60	8.69	126.1
-20	-4	2.01	29.1		18	65	9.47	137.4
-19	-2	2.13	30.9		21	70	10.30	149.4
-18	0	2.26	32.8		24	75	11.18	162.1
-17	2	2.40	34.8		27	80	12.10	175.5
-16	4	2.54	36.8		29	85	13.07	189.6
-14	6	2.68	38.9		32	90	14.10	204.5
-13	8	2.83	41.1		35	95	15.18	220.2
-12	10	2.99	43.3		38	100	16.33	236.8
-11	12	3.14	45.6		41	105	17.53	254.2
-10	14	3.31	48.0		43	110	18.78	272.4
-9	16	3.47	50.4		46	115	20.11	291.6
-8	18	3.65	52.9		49	120	21.50	311.8
-7	20	3.83	55.5		52	125	22.95	332.9
-6	22	4.01	58.1		54	130	24.48	355.0
-4	24	4.20	60.9		57	135	26.07	378.1
-3	26	4.39	63.7		60	140	27.74	402.3
-2	28	4.59	66.5		63	145	29.48	427.6
-1	30	4.79	69.5		66	150	31.30	454.0

SECTION 9

UNIT TROUBLESHOOTING

⚠ CAUTION

Under no circumstances should anyone attempt to service the Advance Microprocessor. See Section 9.4.1 for microprocessor troubleshooting. Should a problem develop with the Advance Microprocessor, contact your nearest Carrier Transicold dealer for replacement.

INDICATION/ TROUBLE	POSSIBLE CAUSES	ACTION/ REFERENCE SECTION
9.1 DIESEL ENGINE - See Table 9-1 and Figure 8-33 thru Figure 9-4 for ESC troubleshooting		
9.1.1 Engine Will Not Start		
Starter motor will not crank or low cranking speed	Battery insufficiently charged Battery terminal post dirty or defective Bad electrical connections at starter Starter motor malfunctions Starter motor solenoid defective Open starting circuit Incorrect grade of lubricating oil Unloaders not unloaded High refrigeration suction pressure	Check Check Check 9.1.3 Engine Manual 9.1.4 2.6 8.15 8.24
Starter motor cranks but engine fails to start	No fuel in tank Air in fuel system Water in fuel system Plugged fuel filter(s) Plugged fuel lines to injector(s) Fuel control operation erratic Glow plug(s) defective Fuel solenoid defective Fuel pump (FP) malfunction	Check 8.3 Drain Sump Replace Check Engine Manual 8.6.8 Engine Manual 8.3
Starter cranks, engages, but dies after a few seconds	Engine lube oil too heavy Voltage drop in battery cable(s)	2.6 Check
9.1.2 Engine Starts Then Stops		
Engine stops after several rotations	Fuel supply restricted No fuel in tank Leak in fuel system Faulty fuel control operation Fuel filter restricted Injector nozzle(s) defective Injection pump defective Air cleaner or hose restricted Safety device open Fuel solenoid defective Fuel pump (FP) malfunction	Check Check Check Engine Replace Engine Manual Engine Manual 8.6.6 2.11 Engine Manual 8.3
9.1.3 Starter Motor Malfunction		
Starter motor will not crank or turns slowly	Battery insufficiently charged Battery cable connections loose or oxidized Battery cables defective Starter brushes shorted out Starter brushes hang up or have no contact Starter solenoid damaged Glow/Crank switch defective Engine lube oil too heavy	Check Check Replace Engine Manual Engine Manual Engine Manual Replace 2.6

INDICATION/ TROUBLE	POSSIBLE CAUSES	ACTION/- REFERENCE SECTION
Starter motor turns but pinion does not engage	Pinion or ring gear obstructed or worn	Clean both, remove burrs, or replace
Starter motor does not disengage after switch was depressed	Glow/Crank switch defective Starter motor solenoid defective Engine is already running	Replace Engine Manual Check
Pinion does not disengage after engine is released	Defective starter	Engine Manual
9.1.4 Malfunction In The Engine Starting Circuit		
No power to starter motor solenoid (SS)	Battery defective Loose electrical connections	Check Tighten
Fuel solenoid does not energize or does not remain energized	Battery defective Loose electrical connections Oil pressure safety switch (ENOPS) defective Run relay (RR) defective Engine coolant temp. (ENCT) defective Fuel solenoid defective Start/Run-Off switch defective	Check Tighten Replace Replace Replace Engine Manual Replace
9.2 ALTERNATOR (12 Volt DC)		
Alternator fails to charge	Limited charging system operating time Battery condition Alternator belt loose/broken Loose, dirty, corroded terminals, or broken leads Excessively worn, open or defective brushes Open blocking diode Regulator faulty Open isolation diode Open rotor (field coil)	Check Check 8.7 Check/Repair Check Check Check Check Replace
Low or unsteady charging rate	Alternator belt loose Loose, dirty, corroded terminals, or broken leads Excessively worn, sticky or intermittent brushes Faulty regulator Grounded or shorted turns in rotor Open, grounded or shorted turns in stator	8.7 Check/Repair Check Check Check Replace
Excessive charging rate (as evidenced by battery requiring too frequent refilling) or amp reading shows constant high amp charge.	Regulator leads loose, dirty, corroded terminals, or wires broken Defective regulator	Clean/Repair Check
Noisy alternator	Defective or badly worn V-belt Worn bearing(s) Misaligned belt or pulley Loose pulley	8.7 Replace 8.7 Tighten

INDICATION/ TROUBLE	POSSIBLE CAUSES	ACTION/- REFERENCE SECTION
9.3 REFRIGERATION		
9.3.1 Unit Will Not Cool		
Diesel engine	Malfunction(s)	9.1
Compressor malfunction	Compressor drive defective Compressor defective	8.13 8.13
Refrigeration system	Defrost cycle did not terminate Abnormal pressure Solenoid valve malfunction Clutch Failure	9.3.6 9.3.7 9.3.12 8.8.5
9.3.2 Unit Runs But Has Insufficient Cooling		
Compressor	Compressor valves defective Unloader malfunction	8.13 8.15
Refrigeration system	Abnormal pressure Unloader malfunction Expansion valve malfunction No or restricted evaporator airflow Clutch Failure	9.3.7 8.15 9.3.11 9.3.10 8.8.5
Engine does not develop full rpm	Speed control linkage Engine malfunction	8.6.4 9.1
9.3.3 System Will Not Pump Down		
	Check SV4	8.23.1
	Check by-pass check valve	8.16
	Check SV2	8.23.1
	Check king valve	
	Check compressor	
9.3.4 Unit Operates Long Or Continuously In Cooling		
Trailer or Rail Car	Hot Load Defective box insulation or air leak	Pre-cool product Correct
Refrigeration system	Abnormal pressure Temperature controller malfunction	9.3.7 9.3.9
Compressor	Defective	8.13
9.3.5 Unit Will Not Heat Or Has Insufficient Heating		
Refrigeration	Abnormal pressure Temperature controller malfunction Solenoid valve malfunction 1/4” check valve (bypass) defective Clutch Failure	9.3.7 9.3.9 9.3.12 8.16 8.8.5
Compressor	Compressor drive defective Compressor defective	8.13 8.13
Engine does not develop full rpm	Engine malfunction FSA malfunction Diagnostic code on ENSCU	9.1 9.4 9.4

INDICATION/ TROUBLE	POSSIBLE CAUSES	ACTION/- REFERENCE SECTION
9.3.6 Defrost Cycle Malfunction		
Will not initiate defrost automatically	Defrost air switch (DAS) out of calibration DTT2 is above 40°F (4.4°C) Defrost air switch (DAS) defective Loose terminal connections Air sensing tubes defective or disconnected	8.26 Cool Box Down 8.25 & 8.26 Tighten Check
Will not initiate defrost manually	Microprocessor defective Loose terminal connections DTT2 is above 40°F (4.4°C) Unit has been running less than 15 seconds	Replace Tighten Cool Box Down Try again
Initiates but does not defrost	Low refrigerant charge Solenoid valve malfunction Clutch/Gearbox defective	8.12 9.3.12 Replace
Frequent defrost	Defrost air switch (DAS) out of adjustment Wet load	8.25 & 8.26 Normal
Does not terminate or cycles on defrost	Low refrigerant charge Defrost air switch (DAS) out of adjustment	8.12 8.25 & 8.26
9.3.7 Abnormal Pressure a. Cooling		
High discharge pressure	Condenser coil dirty Condenser fan defective V-belt broken or loose Discharge check valve restricted Noncondensibles or refrigerant overcharge Solenoid valve (SV1) malfunction	8.28 8.8 8.7 8.16 Replace 8.23.2
Low discharge pressure	SV4 leaking by Compressor valves(s) worn or broken	8.23 8.13
High suction pressure	SV4 leaking by Compressor valves(s) worn or broken Compressor gasket(s) defective	8.23 8.13 8.13
Low suction pressure	Suction service valve partially closed King valve partially closed Filter-drier partially plugged Low refrigerant charge Expansion valve malfunction No evaporator air flow or restricted air flow Excessive frost on coil Solenoid valve (SV2) defective Clutch Failure	Open Open 8.17 8.12 9.3.11 9.3.10 8.25 8.23 8.8.5
Suction and discharge pressures tend to equalize when unit is operating	Compressor valves defective	8.13

INDICATION/ TROUBLE	POSSIBLE CAUSES	ACTION/- REFERENCE SECTION
b. Heating		
High discharge pressure	Solenoid valves (SV1 and SV4) malfunction Condenser fan defective V-belts broken or loose Non-condensables in system	9.3.12 8.8 8.7 Check
Low discharge pressure	Compressor valve(s) worn or broken Solenoid valve (SV1) malfunction Low refrigerant charge	8.13 9.3.12 8.12
Low suction pressure	Refrigerant shortage Solenoid (SV1) open	8.12 9.3.12
9.3.8 Abnormal Noise		
Compressor	Loose mounting bolts Worn bearings Worn or broken valves Liquid slugging Insufficient oil	Tighten 8.13 8.13 9.3.11 8.14
Condenser or evaporator fan	Loose or striking shroud Bearings defective Bent shaft	Check 8.8 8.8
Clutch/Gearbox	Defective	Replace
V-belts	Cracked or worn	8.7
9.3.9 Control System Malfunction		
Will not control	Sensor defective Relay(s) defective Microprocessor controller malfunction	8.29 Check Check
9.3.10 No Evaporator Air Flow Or Restricted Air Flow		
Evaporator coil blocked	Frost on coil Dirty coil	8.25 8.27
No or partial evaporator air flow	V-belt broken or loose Clutch/Gearbox defective Evaporator fan loose or defective Evaporator fan rotating backwards Evaporator air flow blocked in trailer (box)	8.7 Replace 8.8 8.7 Check
9.3.11 Expansion Valve Malfunction		
Low suction pressure with high superheat	Low refrigerant charge External equalizer line plugged Ice formation at valve seat Wax, oil or dirt plugging valve or orifice Broken capillary Power assembly failure or partial loss of element/bulb charge Superheat setting too high	8.10/8.12 Clean 8.11 8.18 8.18 Replace 8.18

INDICATION/ TROUBLE	POSSIBLE CAUSES	ACTION/- REFERENCE SECTION
Low superheat and liquid slugging in compressor	Superheat setting too low External equalizer line plugged Ice holding valve open Foreign material in valve Pin and seat of expansion valve eroded or held open by foreign material	8.18 Open 8.11 Clean 8.18
Fluctuating suction pressure	Improper bulb location or installation Low superheat setting	8.18 8.18
High superheat	Broken capillary	8.18
9.3.12 Solenoid Valve Malfunction		
Solenoid valve does not function properly	No power to valve Improper wiring or loose connections Coil defective Valve improperly assembled Coil or coil sleeve improperly assembled Movement of plunger restricted due to: a. Corroded or worn parts b. Foreign material lodged in valve c. Bent or dented enclosing tub	Check Check 8.23 8.23 8.23 8.23 8.23 8.23
Solenoid valve closes but refrigerant continues to flow	Foreign material lodged under seat Defective seat	Clean Replace

9.4 Electronic Speed Control Troubleshooting

Table 9-1. ENSCU LED Fault Chart (See following pages for troubleshooting trees)

	Fault	LED display pattern	Failed component
1	Engine Over Speed: more than 2,530 RPM	One Long–One Short	ENSSN or mechanical engine problem
2	No signal from ENSSN for 2 seconds after RPM is greater than 1,000 RPM for 10 seconds, **OR** for 5 seconds while engine cranking (no voltage at pin 18 of ENSCU).	Two Long–One Short	ENSSN or wiring problem
3	Actuator (FSA) wiring disconnected or open circuit. Coil Resistance Spec: 2.8 ohm +/- 10%.	Two Long–Three Short	FSA or wiring problem
4	ENSCU supply voltage is greater than 26V.	Two Long–Seven Short	ENSCU or alternator problem

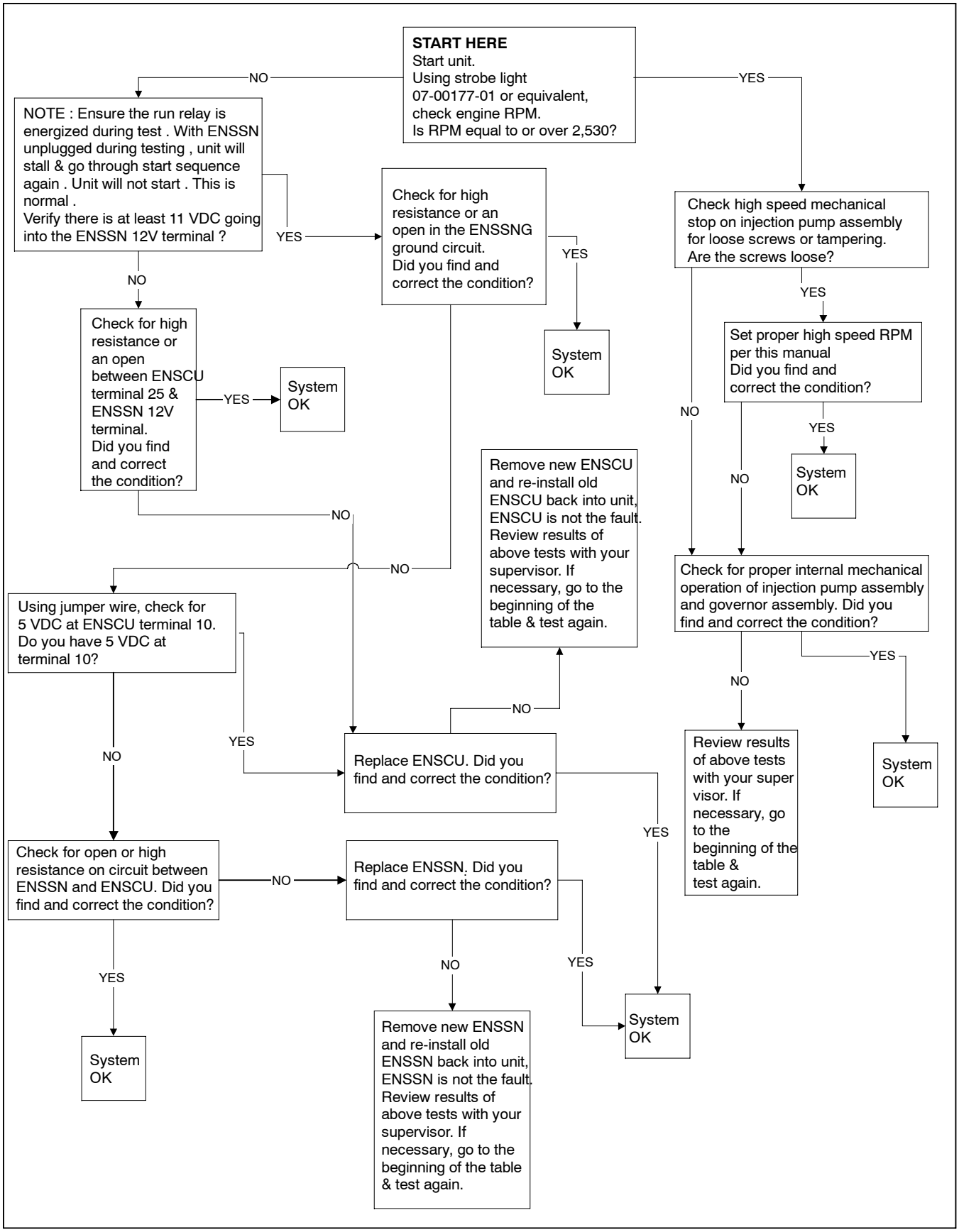

START HERE
Start unit.
Using strobe light
07-00177-01 or equivalent,
check engine RPM.
Is RPM equal to or over 2,530?
NO
YES
NOTE : Ensure the run relay is energized during test . With ENSSN unplugged during testing , unit will stall & go through start sequence again . Unit will not start . This is normal .
Verify there is at least 11 VDC going into the ENSSN 12V terminal ?
YES
NO
Check for high resistance or an open in the ENSSNG ground circuit.
Did you find and correct the condition?
YES
System OK
Check for high resistance or an open between ENSCU terminal 25 & ENSSN 12V terminal.
Did you find and correct the condition?
YES
System OK
NO
NO
Remove new ENSCU and re-install old ENSCU back into unit, ENSCU is not the fault.
Review results of above tests with your supervisor. If necessary, go to the beginning of the table & test again.
Using jumper wire, check for 5 VDC at ENSCU terminal 10.
Do you have 5 VDC at terminal 10?
NO
YES
Replace ENSCU. Did you find and correct the condition?
NO
YES
Check for open or high resistance on circuit between ENSSN and ENSCU. Did you find and correct the condition?
NO
Replace ENSSN. Did you find and correct the condition?
YES
NO
YES
System OK
Remove new ENSSN and re-install old ENSSN back into unit, ENSSN is not the fault.
Review results of above tests with your supervisor. If necessary, go to the beginning of the table & test again.
Check high speed mechanical stop on injection pump assembly for loose screws or tampering.
Are the screws loose?
YES
Set proper high speed RPM per this manual
Did you find and correct the condition?
YES
System OK
NO
NO
Check for proper internal mechanical operation of injection pump assembly and governor assembly. Did you find and correct the condition?
YES
NO
Review results of above tests with your super visor. If necessary, go to the beginning of the table & test again.
System OK

Figure 9-1. ESC Diagnostic Tree - 1 Long, 1 Short LED Code

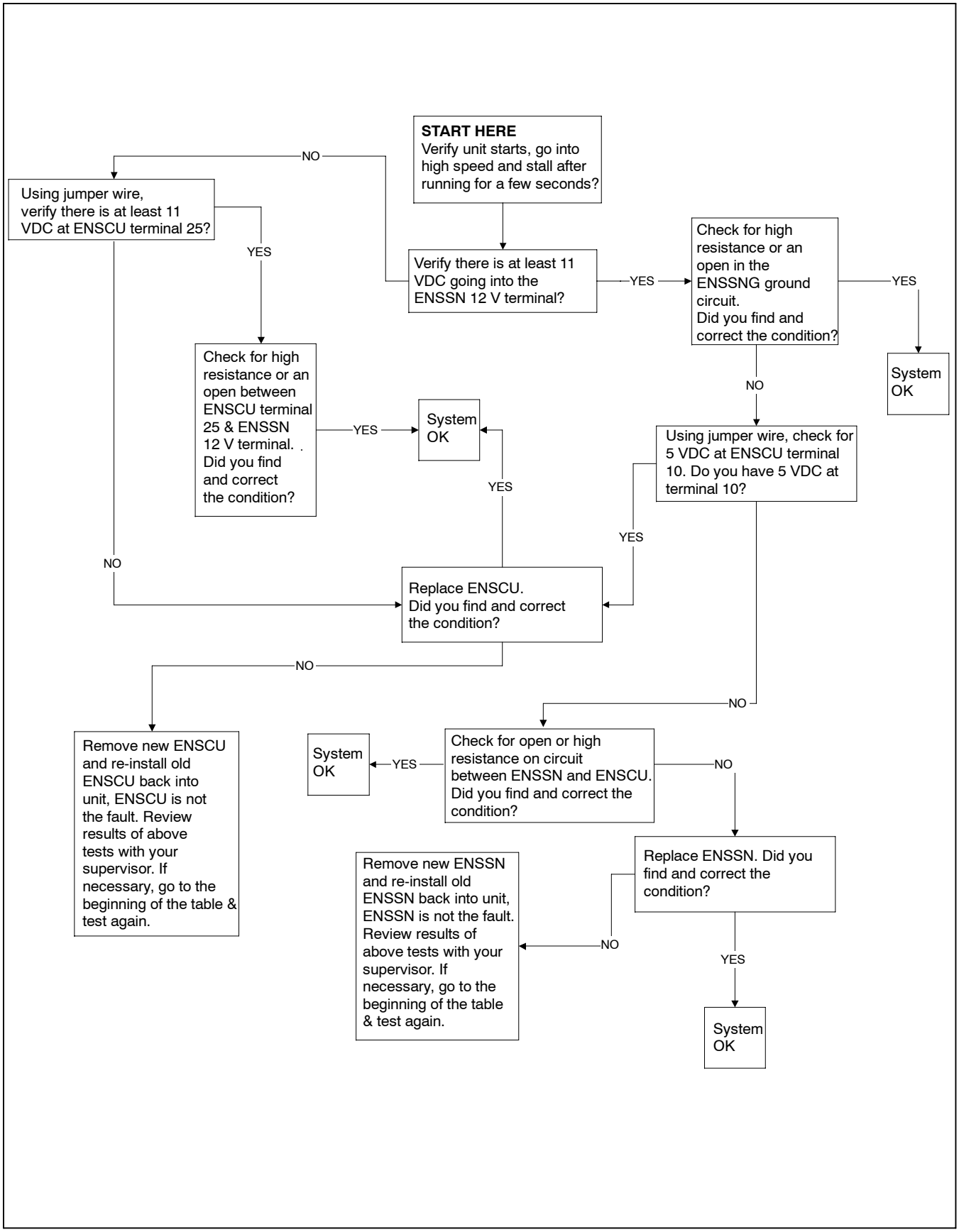

START HERE
Verify unit starts, go into high speed and stall after running for a few seconds?
NO
Using jumper wire, verify there is at least 11 VDC at ENSCU terminal 25?
YES
Verify there is at least 11 VDC going into the ENSSN 12 V terminal?
YES
Check for high resistance or an open in the ENSSNG ground circuit. Did you find and correct the condition?
YES
System OK
NO
Check for high resistance or an open between ENSCU terminal 25 & ENSSN 12 V terminal. Did you find and correct the condition?
YES
System OK
YES
Using jumper wire, check for 5 VDC at ENSCU terminal 10. Do you have 5 VDC at terminal 10?
YES
NO
Replace ENSCU. Did you find and correct the condition?
NO
Remove new ENSCU and re-install old ENSCU back into unit, ENSCU is not the fault. Review results of above tests with your supervisor. If necessary, go to the beginning of the table & test again.
NO
Check for open or high resistance on circuit between ENSSN and ENSCU. Did you find and correct the condition?
YES
System OK
NO
Replace ENSSN. Did you find and correct the condition?
YES
System OK
NO
Remove new ENSSN and re-install old ENSSN back into unit, ENSSN is not the fault. Review results of above tests with your supervisor. If necessary, go to the beginning of the table & test again.

Figure 9-2. ESC Diagnostic Tree - 2 Long, 1 Short LED Code

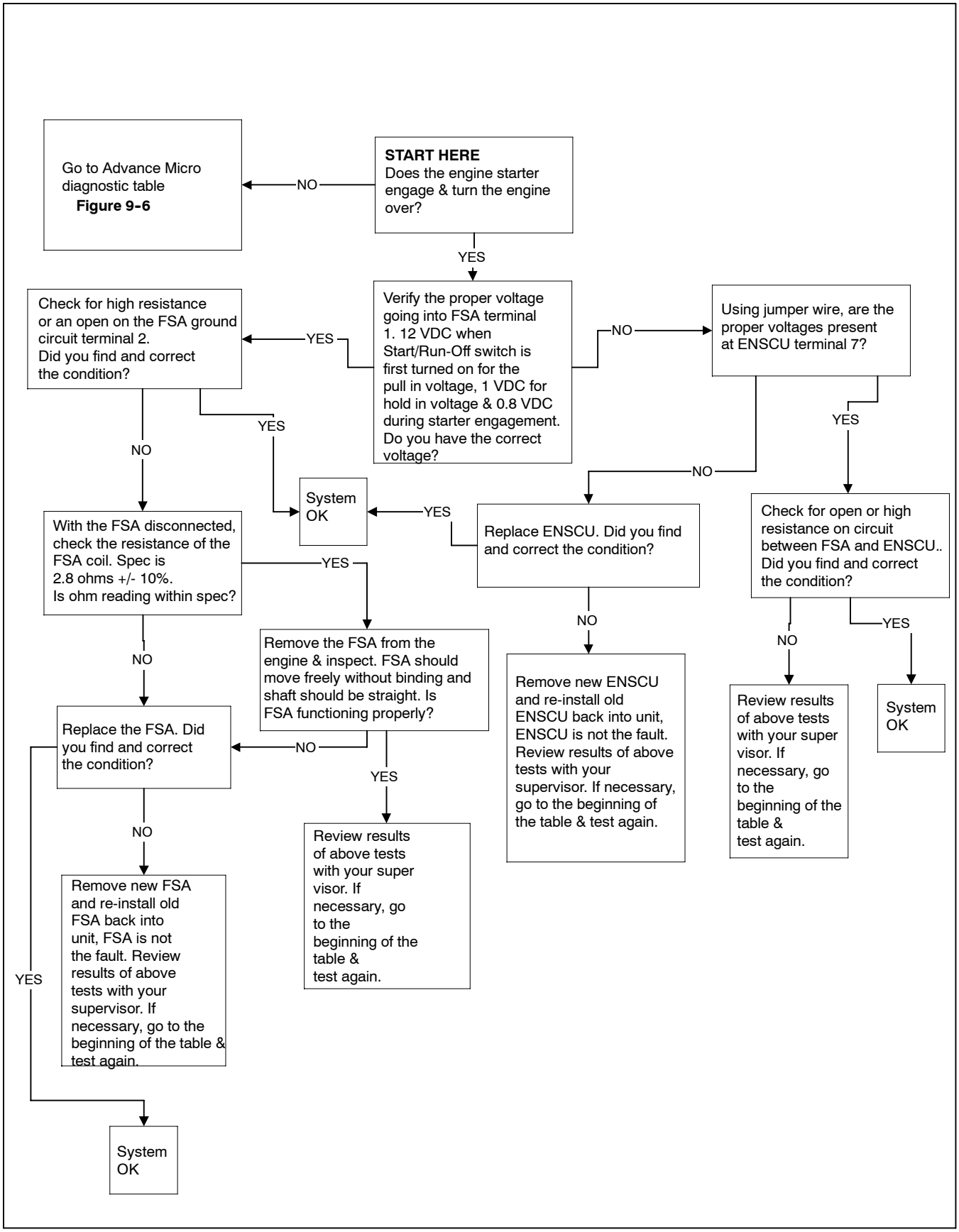

START HERE
Does the engine starter engage & turn the engine over?
NO
Go to Advance Micro diagnostic table
Figure 9-6
YES
Verify the proper voltage going into FSA terminal 1. 12 VDC when Start/Run-Off switch is first turned on for the pull in voltage, 1 VDC for hold in voltage & 0.8 VDC during starter engagement. Do you have the correct voltage?
YES
Check for high resistance or an open on the FSA ground circuit terminal 2. Did you find and correct the condition?
YES
NO
Using jumper wire, are the proper voltages present at ENSCU terminal 7?
YES
NO
System OK
YES
Replace ENSCU. Did you find and correct the condition?
NO
Remove new ENSCU and re-install old ENSCU back into unit, ENSCU is not the fault. Review results of above tests with your supervisor. If necessary, go to the beginning of the table & test again.
Check for open or high resistance on circuit between FSA and ENSCU.. Did you find and correct the condition?
NO
Review results of above tests with your super visor. If necessary, go to the beginning of the table & test again.
YES
System OK
NO
With the FSA disconnected, check the resistance of the FSA coil. Spec is 2.8 ohms +/- 10%. Is ohm reading within spec?
YES
Remove the FSA from the engine & inspect. FSA should move freely without binding and shaft should be straight. Is FSA functioning properly?
NO
Replace the FSA. Did you find and correct the condition?
YES
Review results of above tests with your super visor. If necessary, go to the beginning of the table & test again.
NO
Remove new FSA and re-install old FSA back into unit, FSA is not the fault. Review results of above tests with your supervisor. If necessary, go to the beginning of the table & test again.
YES
System OK

Figure 9-3. ESC Diagnostic Tree - 2 Long, 3 Short LED Code

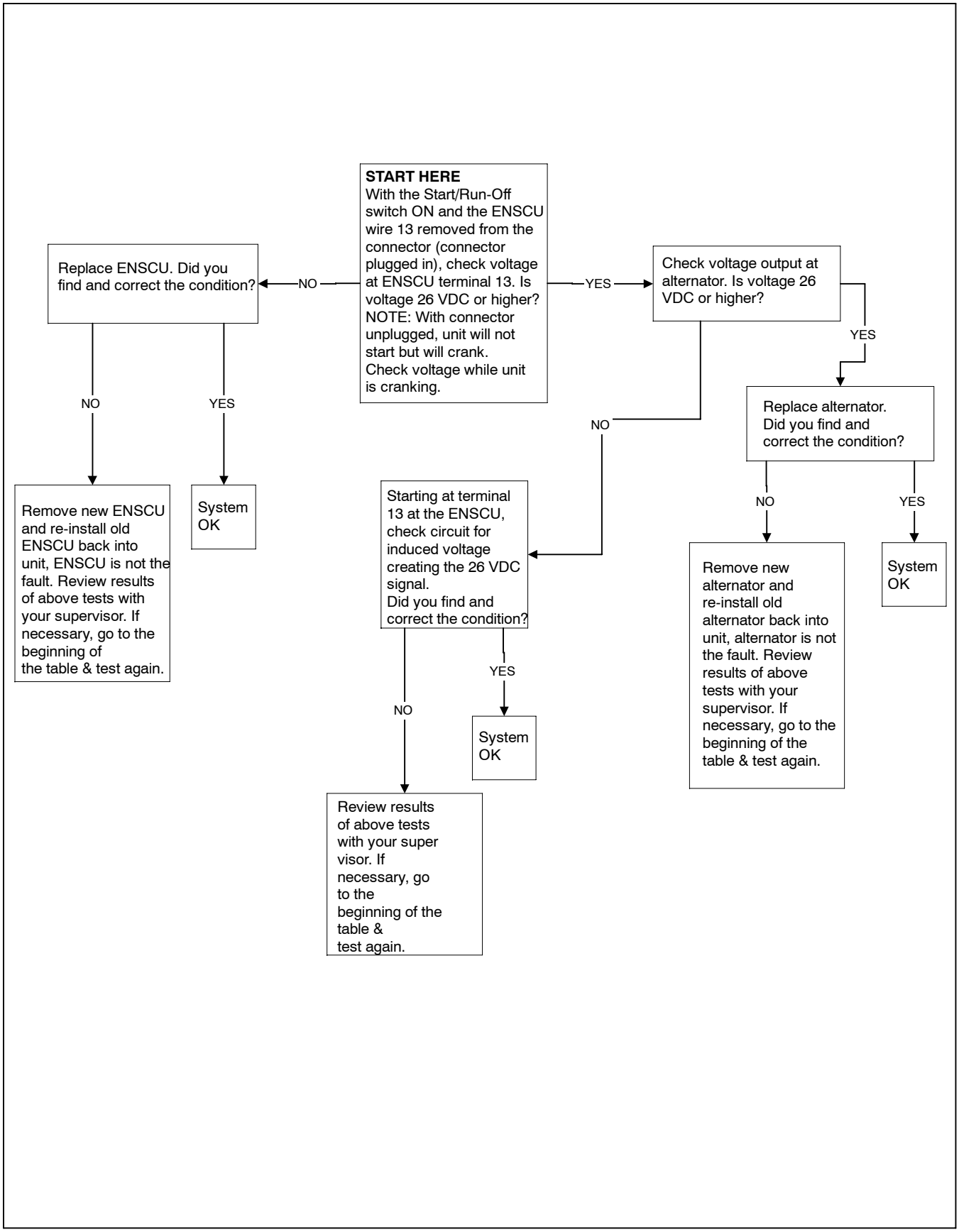

START HERE
With the Start/Run-Off switch ON and the ENSCU wire 13 removed from the connector (connector plugged in), check voltage at ENSCU terminal 13. Is voltage 26 VDC or higher?
NOTE: With connector unplugged, unit will not start but will crank. Check voltage while unit is cranking.
NO
YES
Replace ENSCU. Did you find and correct the condition?
NO
YES
Remove new ENSCU and re-install old ENSCU back into unit, ENSCU is not the fault. Review results of above tests with your supervisor. If necessary, go to the beginning of the table & test again.
System OK
Check voltage output at alternator. Is voltage 26 VDC or higher?
YES
NO
Replace alternator. Did you find and correct the condition?
NO
YES
Remove new alternator and re-install old alternator back into unit, alternator is not the fault. Review results of above tests with your supervisor. If necessary, go to the beginning of the table & test again.
System OK
Starting at terminal 13 at the ENSCU, check circuit for induced voltage creating the 26 VDC signal.
Did you find and correct the condition?
YES
NO
System OK
Review results of above tests with your super visor. If necessary, go to the beginning of the table & test again.

Figure 9-4. ESC Diagnostic Tree - 2 Long, 7 Short LED Code

9.4.1 Advance Microprocessor Troubleshooting Guide

The purpose of the following procedure is to provide a logical and straightforward guide to be used when troubleshooting operational or other problems occurring with the microprocessor. Often users and technicians have mistakenly worked to correct a problem that has ended up being normal operation. The microprocessor has several different conditions contributing to operating parameters. These conditions are called out in the various diagnostic charts to aid the technician in pinpointing the problem, or in realizing that the unit is performing normally.

When using these tables, it is important to verify the reported symptom or problem and then correctly identify the appropriate table for that particular condition. Using the incorrect table will lead to an incorrect diagnosis. A table of contents is included to easily identify the correct table to use.

When using these Diagnostic Tables, it is very important not to skip any steps. Follow the flow of the tables in the order that they are laid out. These tables are formatted into a logical troubleshooting sequence. Skipping around the tables will most likely lead to errors in diagnosis.

Throughout the tables, the steps will point the technician to areas to look at or check for a problem. Most of the steps will lead the technician to a circuit or other area of the unit to check, test, and possibly repair other than the microprocessor. Some steps will point to a possible problem with the microprocessor. Whenever reaching one of these steps, it is a very good practice to install the new microprocessor, then verify unit operation PRIOR TO writing hours, Trailer ID, Unit Serial Number, etc., into the new microprocessor. Once the technician is satisfied that a new microprocessor is required, the hours, trailer ID, unit serial number, customer configurations, or IntelliSets, etc., should be entered. Should the problem remain even with the new microprocessor in place, once all repairs are made, the original microprocessor is to be reinstalled into the unit, to avoid unnecessary costs to the customer or having the Warranty Request rejected if there is no problem found with the returned microprocessor.

All steps leading to replacement of the microprocessor have a number associated with them. When filling out the MPR tag that will be attached to the returned part, write the step number on the upper half of the tag in the Failure Description Field. Include the same information in the Failure Description Field when entering the warranty claim information on line. This will show which diagnostic table was used and the path that was followed to determine the micro was at fault.

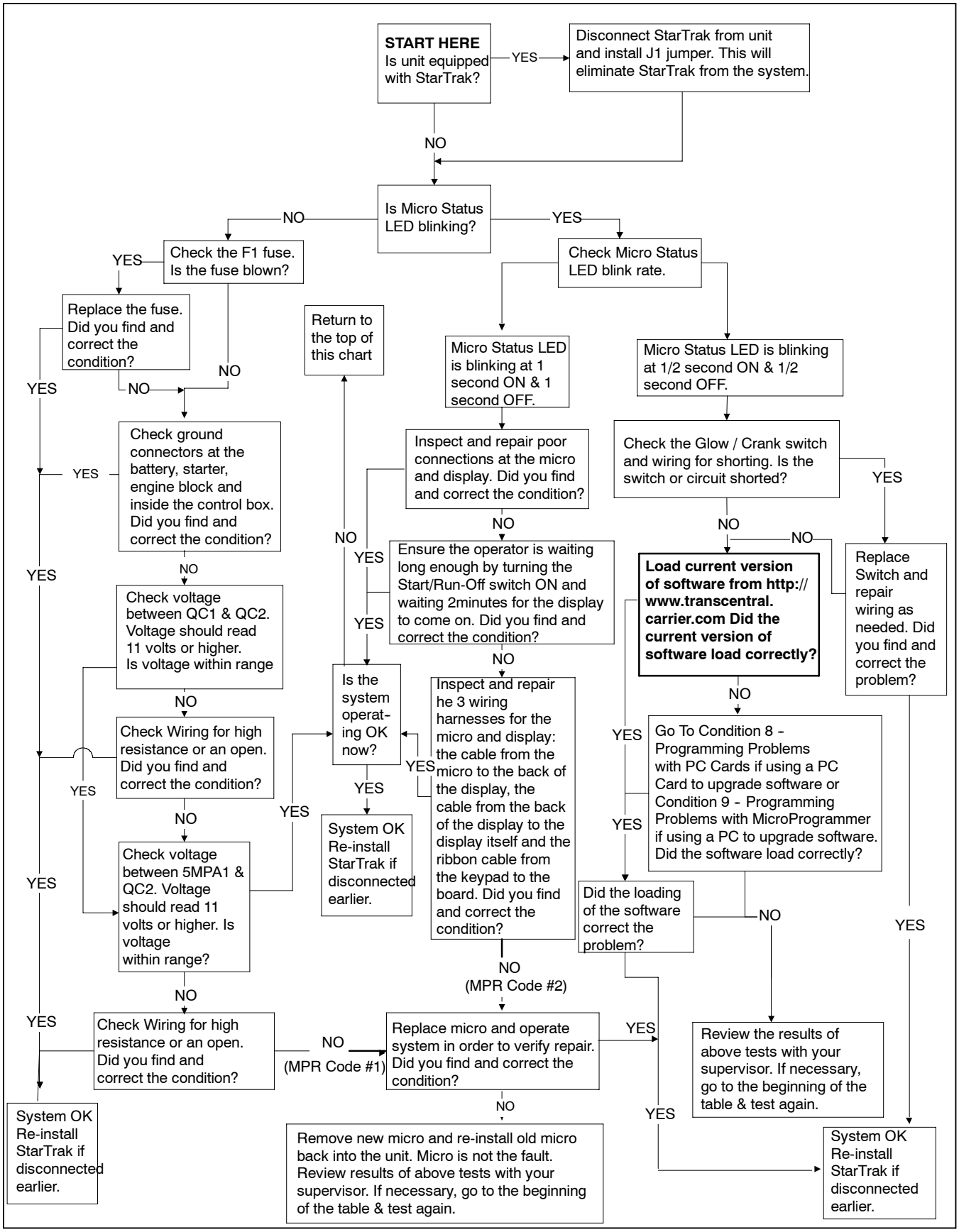

START HERE
Is unit equipped with StarTrak?
YES
Disconnect StarTrak from unit and install J1 jumper. This will eliminate StarTrak from the system.
NO
Is Micro Status LED blinking?
NO
YES
Check the F1 fuse. Is the fuse blown?
YES
Replace the fuse. Did you find and correct the condition?
YES
NO
NO
Check ground connectors at the battery, starter, engine block and inside the control box. Did you find and correct the condition?
YES
NO
Check voltage between QC1 & QC2. Voltage should read 11 volts or higher. Is voltage within range
NO
Check Wiring for high resistance or an open. Did you find and correct the condition?
YES
NO
Check voltage between 5MPA1 & QC2. Voltage should read 11 volts or higher. Is voltage within range?
NO
Check Wiring for high resistance or an open. Did you find and correct the condition?
YES
NO
(MPR Code #1)
System OK Re-install StarTrak if disconnected earlier.
Return to the top of this chart
Check Micro Status LED blink rate.
Micro Status LED is blinking at 1 second ON & 1 second OFF.
Inspect and repair poor connections at the micro and display. Did you find and correct the condition?
NO
YES
Ensure the operator is waiting long enough by turning the Start/Run-Off switch ON and waiting 2minutes for the display to come on. Did you find and correct the condition?
NO
YES
Is the system operating OK now?
YES
NO
System OK Re-install StarTrak if disconnected earlier.
Inspect and repair he 3 wiring harnesses for the micro and display: the cable from the micro to the back of the display, the cable from the back of the display to the display itself and the ribbon cable from the keypad to the board. Did you find and correct the condition?
NO
(MPR Code #2)
Replace micro and operate system in order to verify repair. Did you find and correct the condition?
YES
NO
Remove new micro and re-install old micro back into the unit. Micro is not the fault. Review results of above tests with your supervisor. If necessary, go to the beginning of the table & test again.
Micro Status LED is blinking at 1/2 second ON & 1/2 second OFF.
Check the Glow / Crank switch and wiring for shorting. Is the switch or circuit shorted?
YES
NO
Replace Switch and repair wiring as needed. Did you find and correct the problem?
YES
NO
Load current version of software from http://www.transcentral.carrier.com Did the current version of software load correctly?
NO
YES
Go To Condition 8 - Programming Problems with PC Cards if using a PC Card to upgrade software or Condition 9 - Programming Problems with MicroProgrammer if using a PC to upgrade software. Did the software load correctly?
YES
NO
Did the loading of the software correct the problem?
YES
NO
Review the results of above tests with your supervisor. If necessary, go to the beginning of the table & test again.
YES
System OK Re-install StarTrak if disconnected earlier.

Figure 9-5. Micro Diagnostic Tree - Cond. 1 - Start/Run-Off Switch On - Unit Does Not Operate

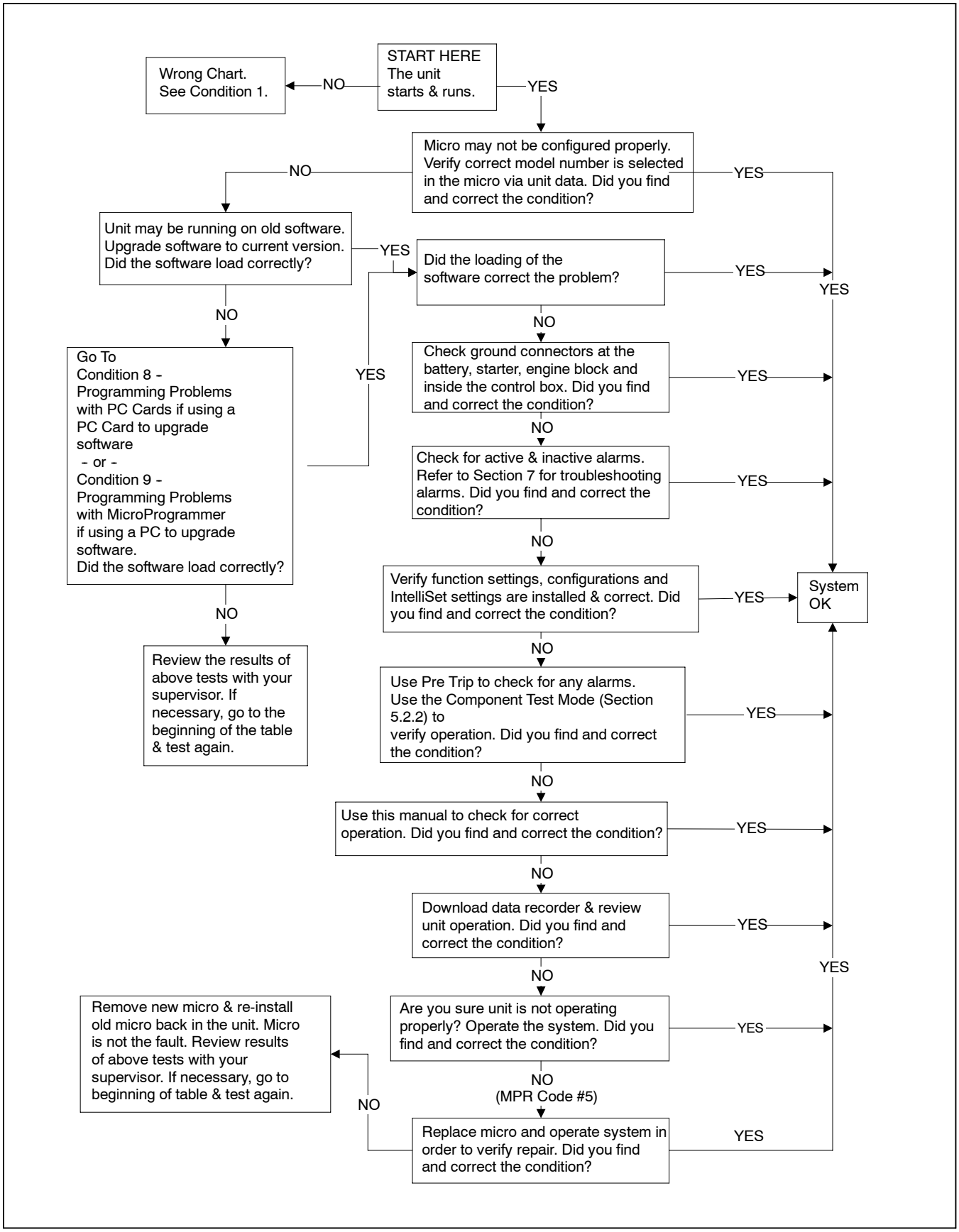


Figure 9-6. Micro Diagnostic Tree - Cond. 2 - Start/Run-Off Switch On - Unit Operates But Not Properly

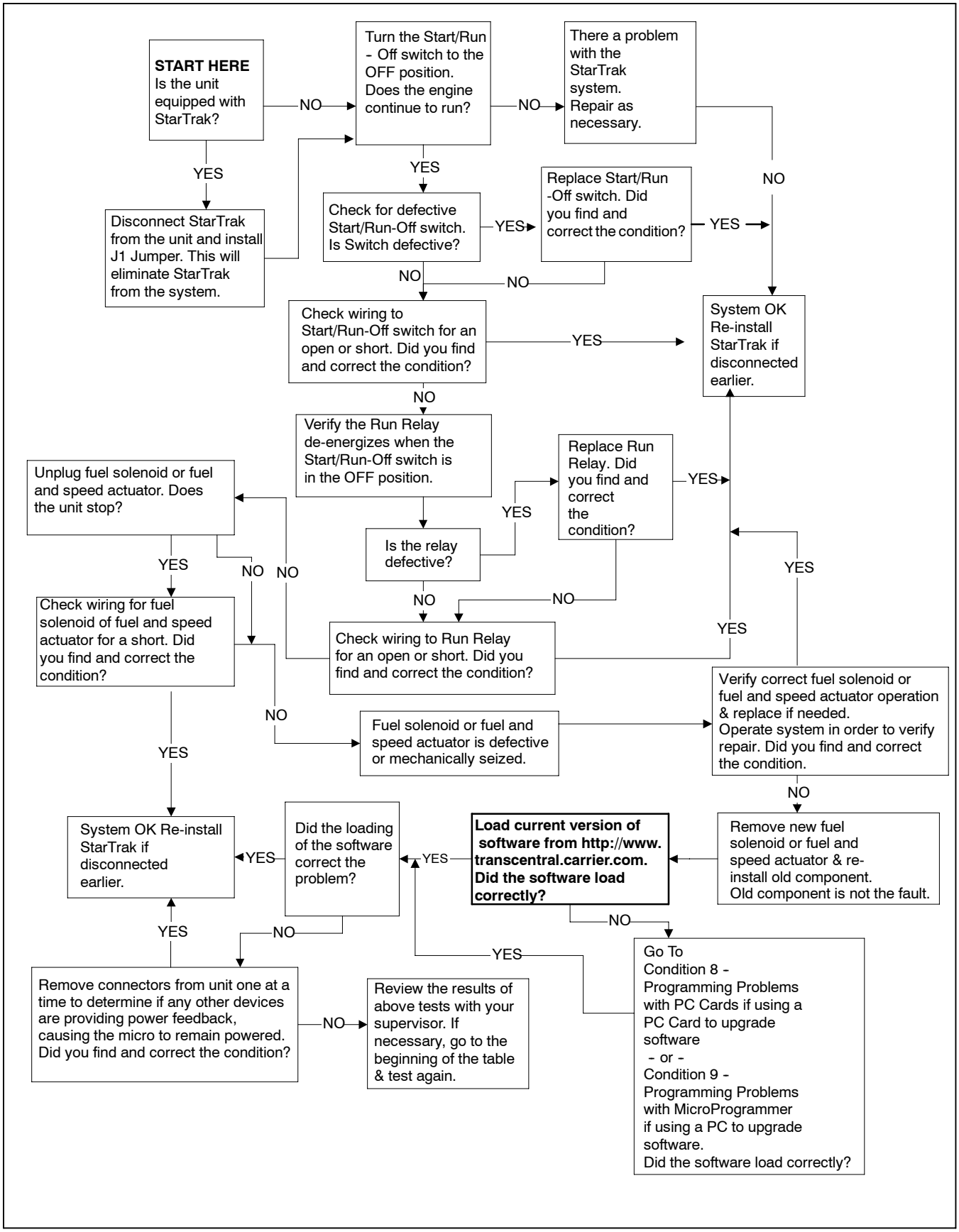

START HERE
Is the unit equipped with StarTrak?
NO
YES
Turn the Start/Run - Off switch to the OFF position. Does the engine continue to run?
NO
YES
There a problem with the StarTrak system. Repair as necessary.
NO
Disconnect StarTrak from the unit and install J1 Jumper. This will eliminate StarTrak from the system.
Check for defective Start/Run-Off switch. Is Switch defective?
YES
Replace Start/Run -Off switch. Did you find and correct the condition?
YES
NO
NO
NO
Check wiring to Start/Run-Off switch for an open or short. Did you find and correct the condition?
YES
System OK Re-install StarTrak if disconnected earlier.
NO
Verify the Run Relay de-energizes when the Start/Run-Off switch is in the OFF position.
Replace Run Relay. Did you find and correct the condition?
YES
Unplug fuel solenoid or fuel and speed actuator. Does the unit stop?
YES
Is the relay defective?
YES
NO
NO
YES
NO
NO
YES
Check wiring for fuel solenoid of fuel and speed actuator for a short. Did you find and correct the condition?
Check wiring to Run Relay for an open or short. Did you find and correct the condition?
YES
Verify correct fuel solenoid or fuel and speed actuator operation & replace if needed. Operate system in order to verify repair. Did you find and correct the condition.
NO
Fuel solenoid or fuel and speed actuator is defective or mechanically seized.
YES
Remove new fuel solenoid or fuel and speed actuator & re-install old component. Old component is not the fault.
Load current version of software from http://www.transcentral.carrier.com. Did the software load correctly?
YES
YES
Did the loading of the software correct the problem?
YES
System OK Re-install StarTrak if disconnected earlier.
NO
YES
Go To Condition 8 - Programming Problems with PC Cards if using a PC Card to upgrade software - or - Condition 9 - Programming Problems with MicroProgrammer if using a PC to upgrade software. Did the software load correctly?
YES
NO
Remove connectors from unit one at a time to determine if any other devices are providing power feedback, causing the micro to remain powered. Did you find and correct the condition?
NO
Review the results of above tests with your supervisor. If necessary, go to the beginning of the table & test again.

Figure 9-7. Micro Diagnostic Tree - Cond. 3 - Start/Run-Off Switch Off - Unit Fails To Stop

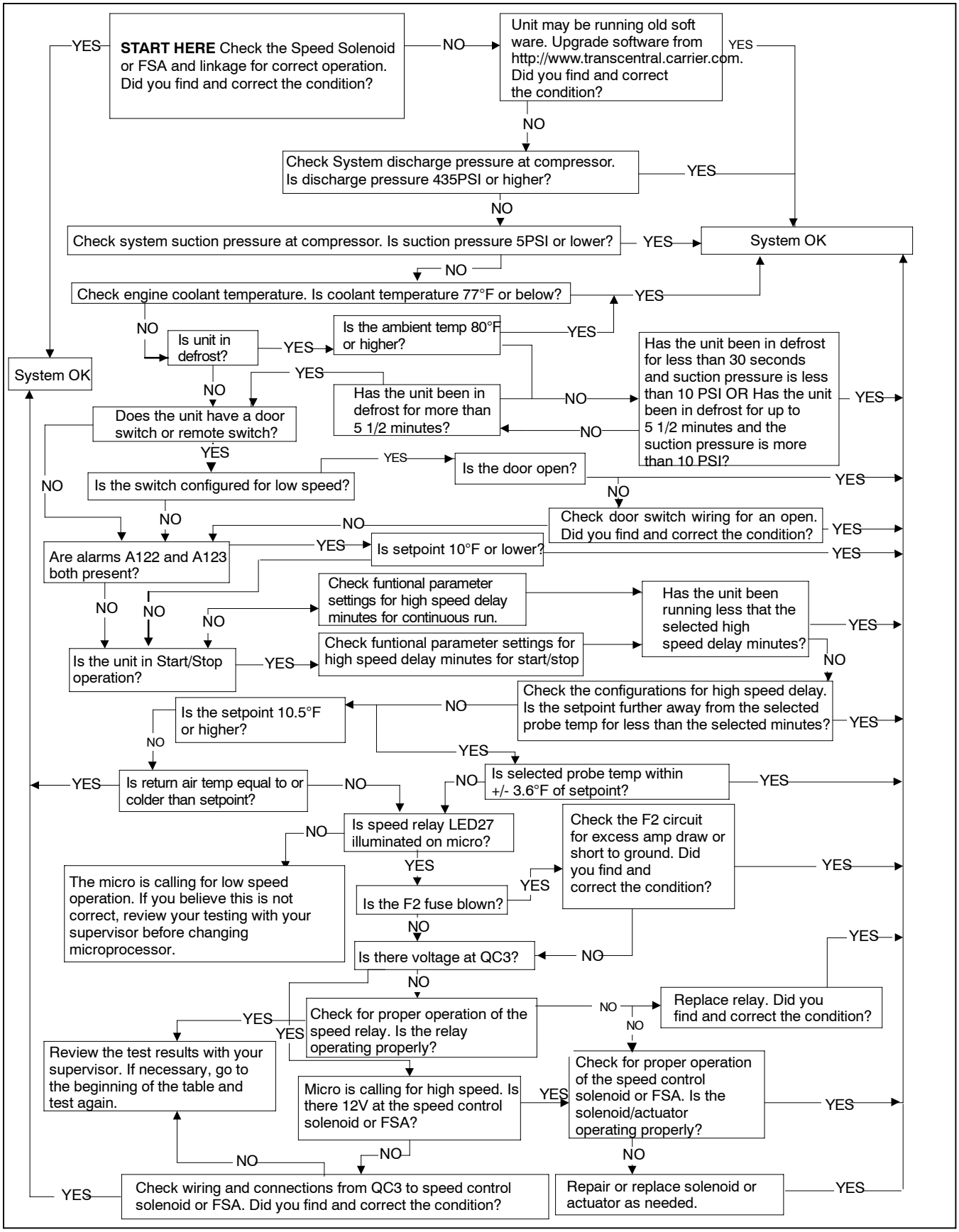

START HERE Check the Speed Solenoid or FSA and linkage for correct operation. Did you find and correct the condition?
YES
NO
Unit may be running old soft ware. Upgrade software from http://www.transcentral.carrier.com. Did you find and correct the condition?
YES
NO
Check System discharge pressure at compressor. Is discharge pressure 435PSI or higher?
YES
NO
Check system suction pressure at compressor. Is suction pressure 5PSI or lower?
YES
System OK
NO
Check engine coolant temperature. Is coolant temperature 77°F or below?
YES
NO
Is unit in defrost?
YES
Is the ambient temp 80°F or higher?
YES
System OK
NO
YES
Has the unit been in defrost for more than 5 1/2 minutes?
NO
Has the unit been in defrost for less than 30 seconds and suction pressure is less than 10 PSI OR Has the unit been in defrost for up to 5 1/2 minutes and the suction pressure is more than 10 PSI?
YES
Does the unit have a door switch or remote switch?
YES
YES
Is the door open?
YES
NO
Is the switch configured for low speed?
NO
NO
Check door switch wiring for an open. Did you find and correct the condition?
YES
NO
YES
Are alarms A122 and A123 both present?
YES
Is setpoint 10°F or lower?
YES
NO
NO
NO
Check funtional parameter settings for high speed delay minutes for continuous run.
Has the unit been running less that the selected high speed delay minutes?
YES
NO
Is the unit in Start/Stop operation?
YES
Check funtional parameter settings for high speed delay minutes for start/stop
Check the configurations for high speed delay. Is the setpoint further away from the selected probe temp for less than the selected minutes?
YES
NO
Is the setpoint 10.5°F or higher?
NO
NO
YES
YES
Is return air temp equal to or colder than setpoint?
NO
NO
Is selected probe temp within +/- 3.6°F of setpoint?
YES
NO
Is speed relay LED27 illuminated on micro?
Check the F2 circuit for excess amp draw or short to ground. Did you find and correct the condition?
YES
YES
The micro is calling for low speed operation. If you believe this is not correct, review your testing with your supervisor before changing microprocessor.
YES
Is the F2 fuse blown?
NO
NO
Is there voltage at QC3?
YES
NO
NO
Replace relay. Did you find and correct the condition?
YES
NO
YES
Check for proper operation of the speed relay. Is the relay operating properly?
YES
Review the test results with your supervisor. If necessary, go to the beginning of the table and test again.
Micro is calling for high speed. Is there 12V at the speed control solenoid or FSA?
YES
Check for proper operation of the speed control solenoid or FSA. Is the solenoid/actuator operating properly?
YES
NO
NO
NO
YES
Check wiring and connections from QC3 to speed control solenoid or FSA. Did you find and correct the condition?
Repair or replace solenoid or actuator as needed.
YES

Figure 9-8. Micro Diagnostic Tree - Cond. 4 - Unit Will Not Run In High Speed

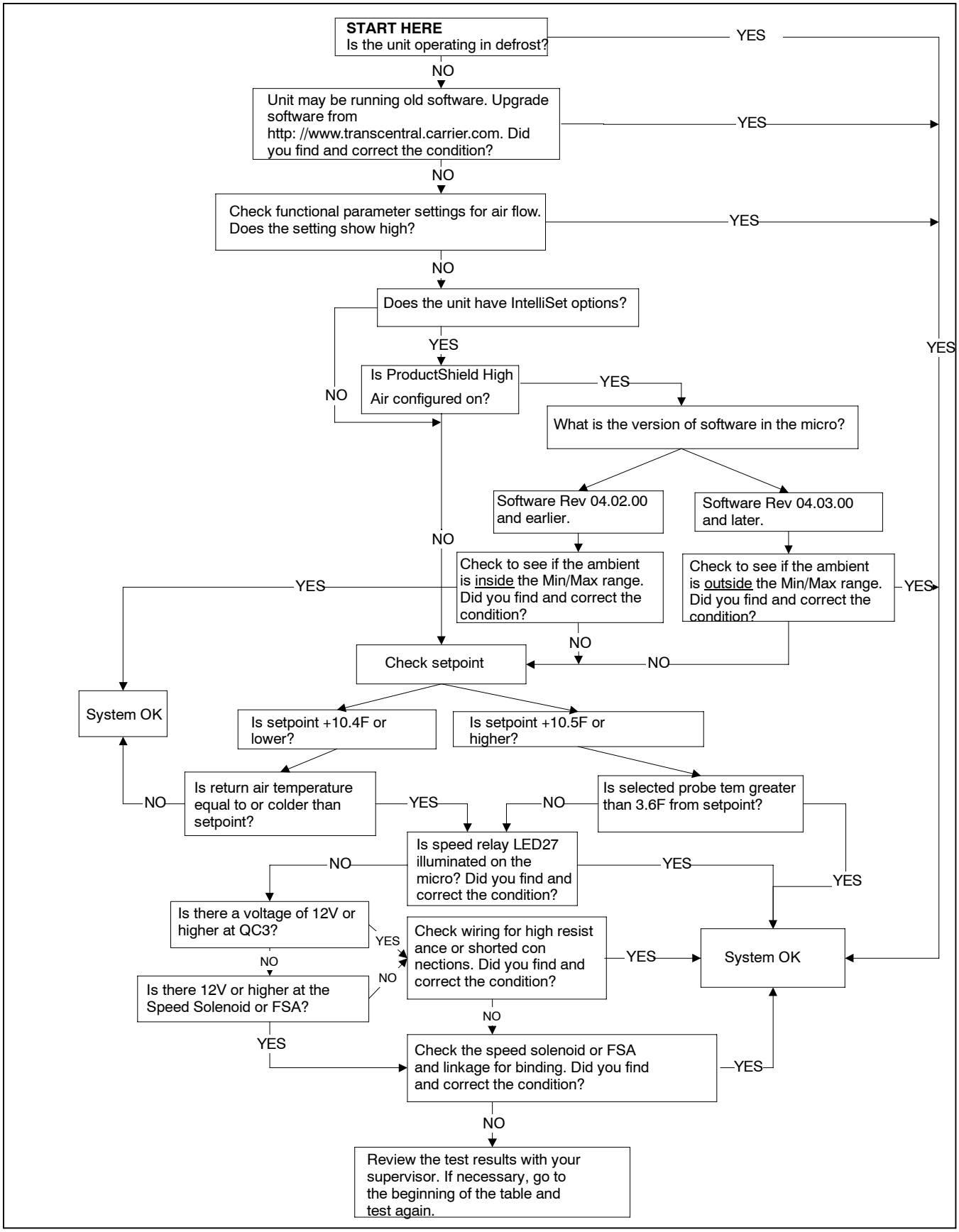

START HERE
Is the unit operating in defrost?
YES
NO
Unit may be running old software. Upgrade software from http: //www.transcentral.carrier.com. Did you find and correct the condition?
YES
NO
Check functional parameter settings for air flow. Does the setting show high?
YES
NO
Does the unit have IntelliSet options?
YES
NO
Is ProductShield High Air configured on?
YES
What is the version of software in the micro?
Software Rev 04.02.00 and earlier.
Software Rev 04.03.00 and later.
NO
Check to see if the ambient is inside the Min/Max range. Did you find and correct the condition?
YES
Check to see if the ambient is outside the Min/Max range. Did you find and correct the condition?
YES
NO
NO
Check setpoint
System OK
Is setpoint +10.4F or lower?
Is setpoint +10.5F or higher?
NO
Is return air temperature equal to or colder than setpoint?
YES
NO
Is selected probe tem greater than 3.6F from setpoint?
YES
NO
Is speed relay LED27 illuminated on the micro? Did you find and correct the condition?
YES
YES
NO
Is there a voltage of 12V or higher at QC3?
YES
NO
Is there 12V or higher at the Speed Solenoid or FSA?
NO
Check wiring for high resist ance or shorted con nections. Did you find and correct the condition?
YES
System OK
NO
YES
Check the speed solenoid or FSA and linkage for binding. Did you find and correct the condition?
YES
NO
Review the test results with your supervisor. If necessary, go to the beginning of the table and test again.

Figure 9-9. Micro Diagnostic Tree - Cond. 5 - Unit Will Not Run In Low Speed

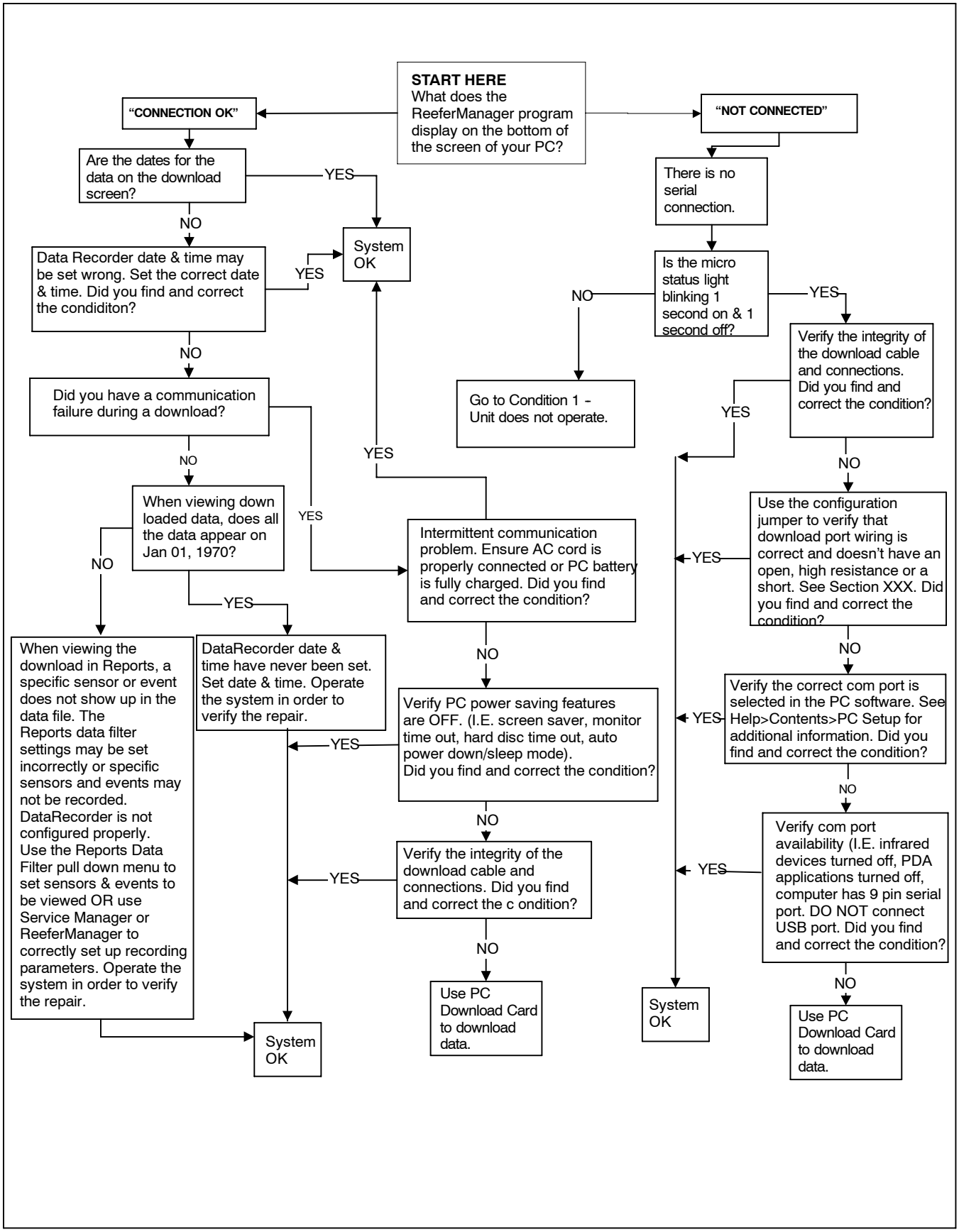

START HERE
What does the ReeferManager program display on the bottom of the screen of your PC?
"CONNECTION OK"
"NOT CONNECTED"
Are the dates for the data on the download screen?
YES
NO
System OK
Data Recorder date & time may be set wrong. Set the correct date & time. Did you find and correct the condiditon?
YES
NO
Did you have a communication failure during a download?
NO
YES
When viewing down loaded data, does all the data appear on Jan 01, 1970?
YES
NO
Intermittent communication problem. Ensure AC cord is properly connected or PC battery is fully charged. Did you find and correct the condition?
NO
When viewing the download in Reports, a specific sensor or event does not show up in the data file. The Reports data filter settings may be set incorrectly or specific sensors and events may not be recorded. DataRecorder is not configured properly. Use the Reports Data Filter pull down menu to set sensors & events to be viewed OR use Service Manager or ReeferManager to correctly set up recording parameters. Operate the system in order to verify the repair.
DataRecorder date & time have never been set. Set date & time. Operate the system in order to verify the repair.
YES
Verify PC power saving features are OFF. (I.E. screen saver, monitor time out, hard disc time out, auto power down/sleep mode). Did you find and correct the condition?
NO
YES
Verify the integrity of the download cable and connections. Did you find and correct the c ondition?
NO
Use PC Download Card to download data.
System OK
There is no serial connection.
Is the micro status light blinking 1 second on & 1 second off?
NO
YES
Go to Condition 1 - Unit does not operate.
Verify the integrity of the download cable and connections. Did you find and correct the condition?
YES
NO
Use the configuration jumper to verify that download port wiring is correct and doesn't have an open, high resistance or a short. See Section XXX. Did you find and correct the condition?
YES
NO
Verify the correct com port is selected in the PC software. See Help>Contents>PC Setup for additional information. Did you find and correct the condition?
YES
NO
Verify com port availability (I.E. infrared devices turned off, PDA applications turned off, computer has 9 pin serial port. DO NOT connect USB port. Did you find and correct the condition?
YES
NO
Use PC Download Card to download data.
System OK

Figure 9-10. Micro Diagnostic Tree - Cond. 6 - Data Recorder Data Download Problems When Using ReeferManager and a Download Cable. Data File Analysis Problems Using Reports

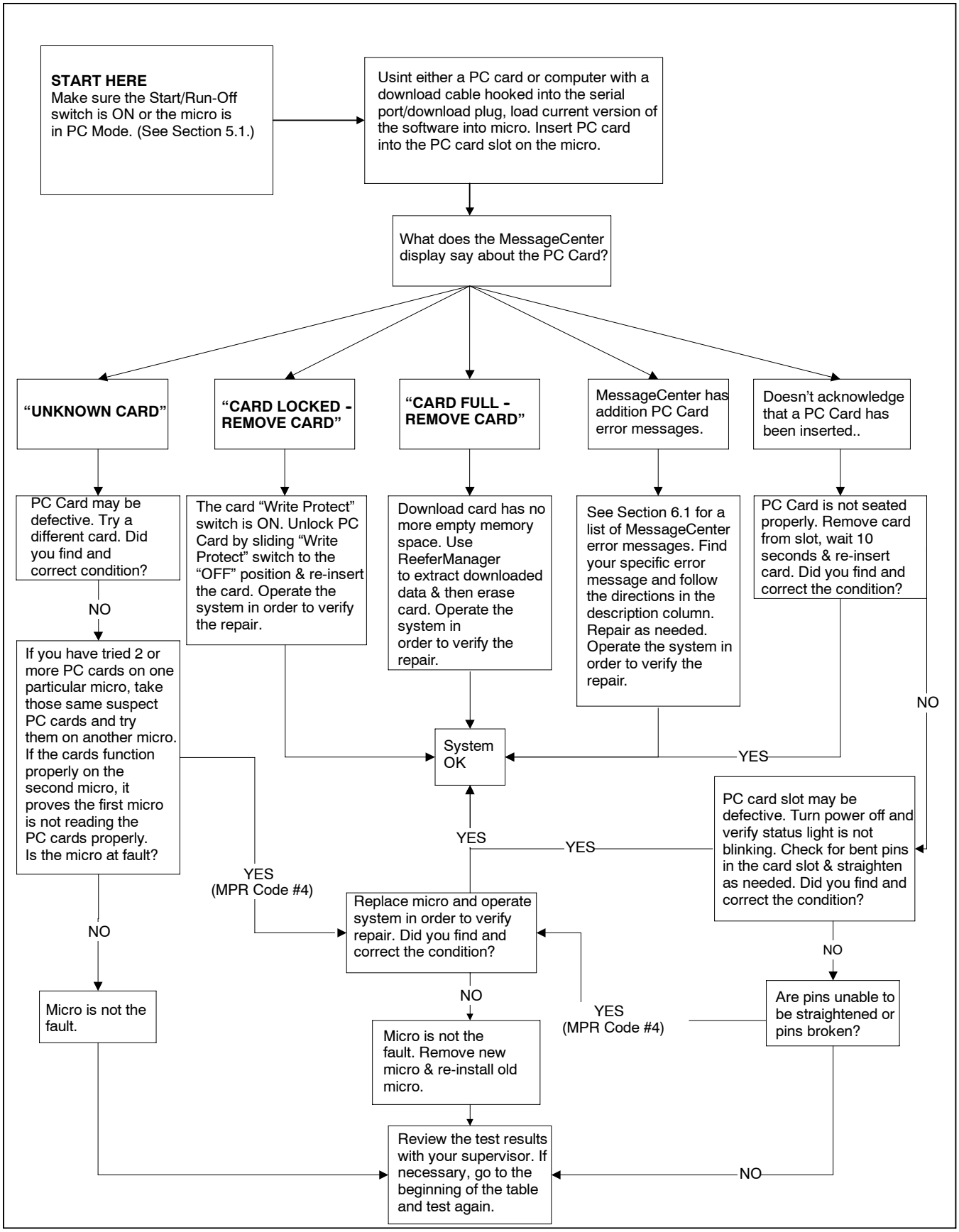

START HERE
Make sure the Start/Run-Off switch is ON or the micro is in PC Mode. (See Section 5.1.)
Usint either a PC card or computer with a download cable hooked into the serial port/download plug, load current version of the software into micro. Insert PC card into the PC card slot on the micro.
What does the MessageCenter display say about the PC Card?
"UNKNOWN CARD"
"CARD LOCKED - REMOVE CARD"
"CARD FULL - REMOVE CARD"
MessageCenter has addition PC Card error messages.
Doesn't acknowledge that a PC Card has been inserted..
PC Card may be defective. Try a different card. Did you find and correct condition?
The card "Write Protect" switch is ON. Unlock PC Card by sliding "Write Protect" switch to the "OFF" position & re-insert the card. Operate the system in order to verify the repair.
Download card has no more empty memory space. Use ReeferManager to extract downloaded data & then erase card. Operate the system in order to verify the repair.
See Section 6.1 for a list of MessageCenter error messages. Find your specific error message and follow the directions in the description column. Repair as needed. Operate the system in order to verify the repair.
PC Card is not seated properly. Remove card from slot, wait 10 seconds & re-insert card. Did you find and correct the condition?
NO
If you have tried 2 or more PC cards on one particular micro, take those same suspect PC cards and try them on another micro. If the cards function properly on the second micro, it proves the first micro is not reading the PC cards properly. Is the micro at fault?
System OK
YES
NO
YES
YES
(MPR Code #4)
PC card slot may be defective. Turn power off and verify status light is not blinking. Check for bent pins in the card slot & straighten as needed. Did you find and correct the condition?
NO
Replace micro and operate system in order to verify repair. Did you find and correct the condition?
NO
Micro is not the fault.
NO
Micro is not the fault. Remove new micro & re-install old micro.
YES
(MPR Code #4)
Are pins unable to be straightened or pins broken?
Review the test results with your supervisor. If necessary, go to the beginning of the table and test again.
NO

Figure 9-11. Microprocessor Diagnostic Tree – PC Card Problems

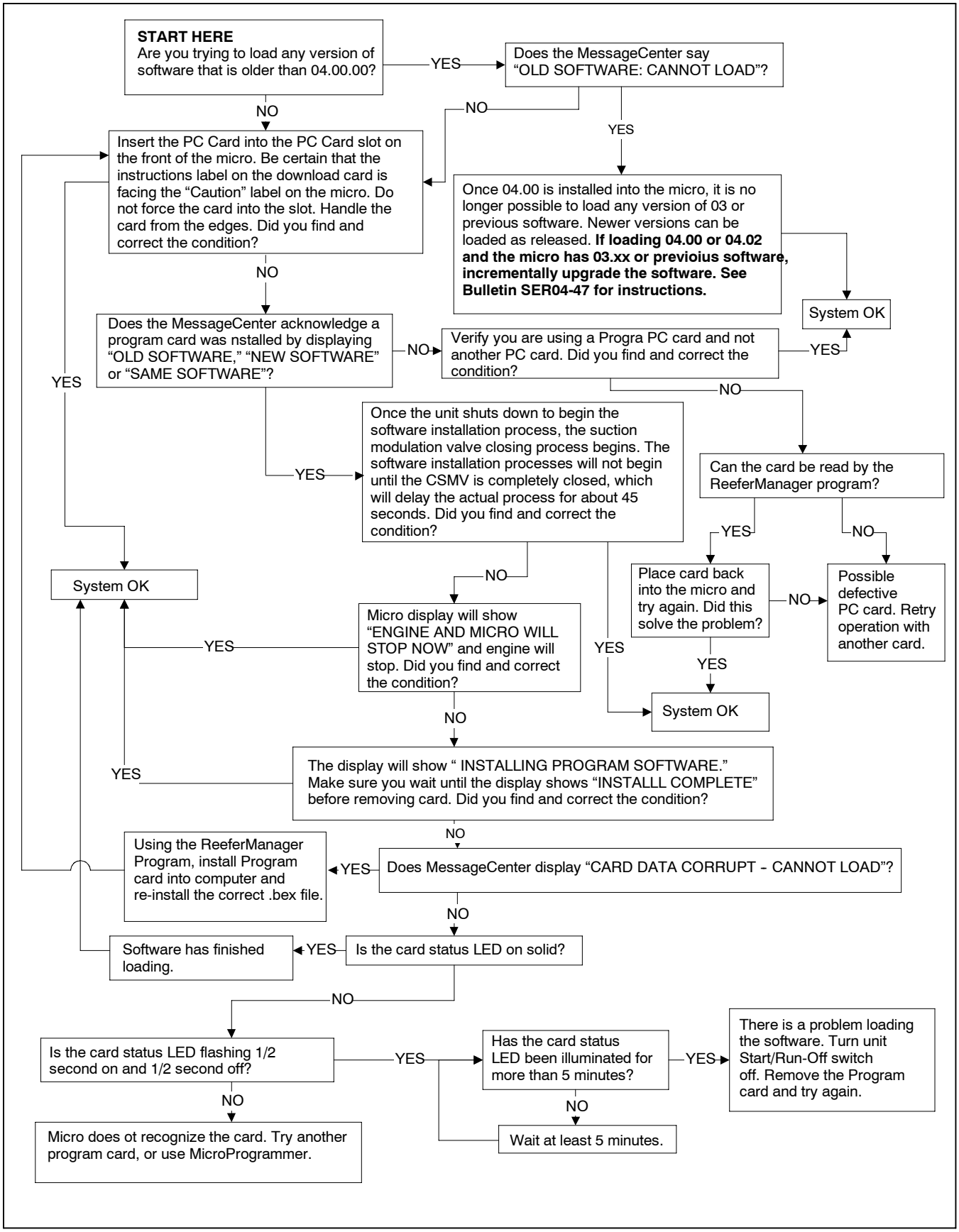

START HERE
Are you trying to load any version of software that is older than 04.00.00?
YES
Does the MessageCenter say "OLD SOFTWARE: CANNOT LOAD"?
NO
NO
YES
Insert the PC Card into the PC Card slot on the front of the micro. Be certain that the instructions label on the download card is facing the "Caution" label on the micro. Do not force the card into the slot. Handle the card from the edges. Did you find and correct the condition?
Once 04.00 is installed into the micro, it is no longer possible to load any version of 03 or previous software. Newer versions can be loaded as released. If loading 04.00 or 04.02 and the micro has 03.xx or previoius software, incrementally upgrade the software. See Bulletin SER04-47 for instructions.
NO
System OK
Does the MessageCenter acknowledge a program card was nstalled by displaying "OLD SOFTWARE," "NEW SOFTWARE" or "SAME SOFTWARE"?
NO
Verify you are using a Progra PC card and not another PC card. Did you find and correct the condition?
YES
YES
NO
YES
Once the unit shuts down to begin the software installation process, the suction modulation valve closing process begins. The software installation processes will not begin until the CSMV is completely closed, which will delay the actual process for about 45 seconds. Did you find and correct the condition?
Can the card be read by the ReeferManager program?
YES
NO
System OK
NO
Place card back into the micro and try again. Did this solve the problem?
NO
Possible defective PC card. Retry operation with another card.
YES
Micro display will show "ENGINE AND MICRO WILL STOP NOW" and engine will stop. Did you find and correct the condition?
YES
YES
System OK
NO
YES
The display will show " INSTALLING PROGRAM SOFTWARE." Make sure you wait until the display shows "INSTALLL COMPLETE" before removing card. Did you find and correct the condition?
NO
Using the ReeferManager Program, install Program card into computer and re-install the correct .bex file.
YES
Does MessageCenter display "CARD DATA CORRUPT - CANNOT LOAD"?
NO
Software has finished loading.
YES
Is the card status LED on solid?
NO
Is the card status LED flashing 1/2 second on and 1/2 second off?
YES
Has the card status LED been illuminated for more than 5 minutes?
YES
There is a problem loading the software. Turn unit Start/Run-Off switch off. Remove the Program card and try again.
NO
NO
Micro does ot recognize the card. Try another program card, or use MicroProgrammer.
Wait at least 5 minutes.

Figure 9-12. Micro Diagnostic Tree - Cond. 8 - Programming Problems With PC Cards

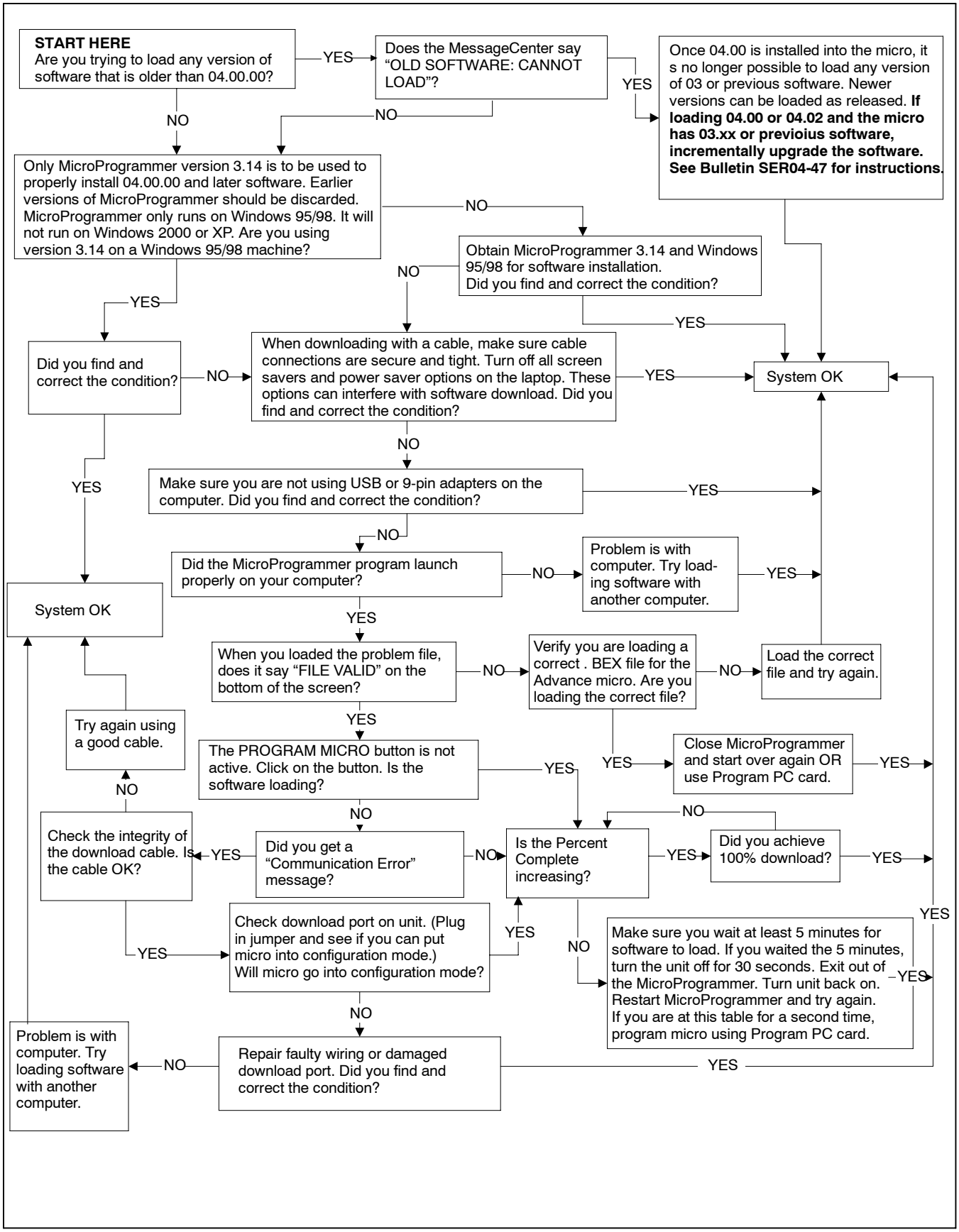
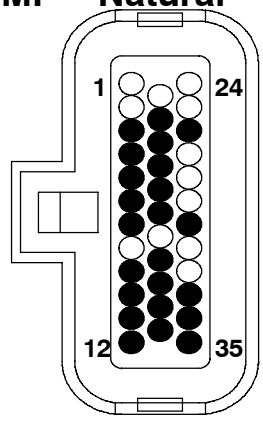

START HERE
Are you trying to load any version of software that is older than 04.00.00?
YES
Does the MessageCenter say "OLD SOFTWARE: CANNOT LOAD"?
YES
Once 04.00 is installed into the micro, it s no longer possible to load any version of 03 or previous software. Newer versions can be loaded as released. If loading 04.00 or 04.02 and the micro has 03.xx or previoius software, incrementally upgrade the software. See Bulletin SER04-47 for instructions.
NO
NO
Only MicroProgrammer version 3.14 is to be used to properly install 04.00.00 and later software. Earlier versions of MicroProgrammer should be discarded. MicroProgrammer only runs on Windows 95/98. It will not run on Windows 2000 or XP. Are you using version 3.14 on a Windows 95/98 machine?
NO
Obtain MicroProgrammer 3.14 and Windows 95/98 for software installation. Did you find and correct the condition?
NO
YES
YES
Did you find and correct the condition?
NO
When downloading with a cable, make sure cable connections are secure and tight. Turn off all screen savers and power saver options on the laptop. These options can interfere with software download. Did you find and correct the condition?
YES
System OK
NO
YES
Make sure you are not using USB or 9-pin adapters on the computer. Did you find and correct the condition?
YES
NO
Did the MicroProgrammer program launch properly on your computer?
NO
Problem is with computer. Try loading software with another computer.
YES
System OK
YES
When you loaded the problem file, does it say "FILE VALID" on the bottom of the screen?
NO
Verify you are loading a correct . BEX file for the Advance micro. Are you loading the correct file?
NO
Load the correct file and try again.
YES
Try again using a good cable.
The PROGRAM MICRO button is not active. Click on the button. Is the software loading?
YES
YES
Close MicroProgrammer and start over again OR use Program PC card.
YES
NO
NO
NO
Check the integrity of the download cable. Is the cable OK?
YES
Did you get a "Communication Error" message?
NO
Is the Percent Complete increasing?
YES
Did you achieve 100% download?
YES
YES
Check download port on unit. (Plug in jumper and see if you can put micro into configuration mode.) Will micro go into configuration mode?
YES
NO
Make sure you wait at least 5 minutes for software to load. If you waited the 5 minutes, turn the unit off for 30 seconds. Exit out of the MicroProgrammer. Turn unit back on. Restart MicroProgrammer and try again. If you are at this table for a second time, program micro using Program PC card.
YES
NO
Problem is with computer. Try loading software with another computer.
NO
Repair faulty wiring or damaged download port. Did you find and correct the condition?
YES

Figure 9-13. Micro Diagnostic Tree - Cond. 9 - Programming Problems With MicroProgrammer

SECTION 10
WIRING

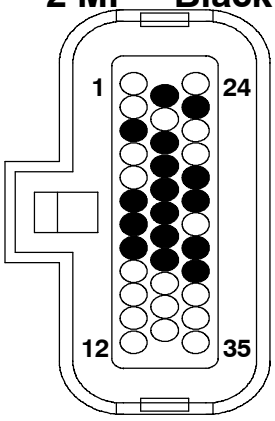
Plugs used with Schematic 62-10499 Rev V (Standard Engine)

1 MP - Natural



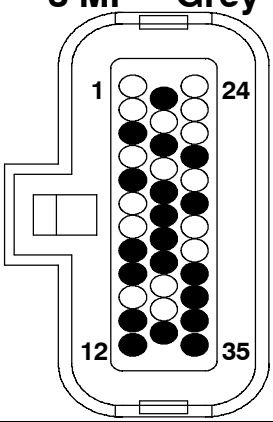
Component	Terminal
REMSN1	3 (14)
REMSN2	4 (14)
CDP	5 (16) (30)
CSP	6 (17) (30)
ENCT	7 (18)
CDT	9 (20)
DTT2	10 (21)
AAT	11 (22)
RAT	12 (23)
REMSN1 (SP23)	14 (3)
REMSN2 (SP23)	14 (4)
REMSN3	15 (33)
CDP	16 (5) (30)
CSP	17 (6) (30)
ENCT	18 (7)
CDT	20 (9)
DTT2 (SP11)	21 (10)
AAT	22 (11)
SAT (SP12)	23 (35)
RAT (SP12)	23 (12)
FLS	26
CDP (SPK4)	30 (5) (16)
CSP (SPK4)	30 (6) (17)

2 MP - Black



Component	Terminal
REMS1	3
DAS	6
ENRPM	7 (18) (31)
CSMV-D	8 (19) (20) (32)
REMS2	13
ENCLS	15
DS	16
ENOPS	17
ENRPM	18 (7) (31)
CSMV-C	19 (8) (20) (32)
CSMV -A	20 (8) (19) (32)
HC9	25
ENOLS	28
HPS	29
ENRPM	31 (7) (18)
CSMV-B	32 (8) (19) (20)

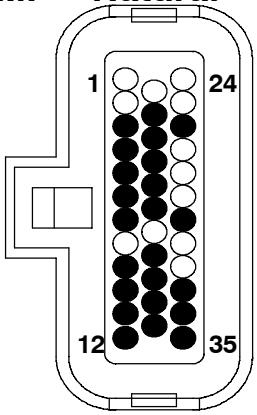
3 MP - Grey



Component	Terminal
SATCOM (C)	3
SLP (C)	5
ORL	8
CL	9
SV2	11
UL1 (Front)	12
SLP (E)	13
SATCOM (B)	15
SLP (A)	17
FHR (HC-17)	18
FL	19
DL	20
UL2 (Rear)	23
SATCOM (A)	27
SLP (B)	29
HL	33
SV4	34
SV1	35

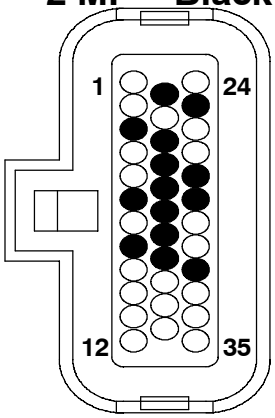
Plugs used with Schematic 62-04102 Rev - (ESC Engine)

1 MP - Natural



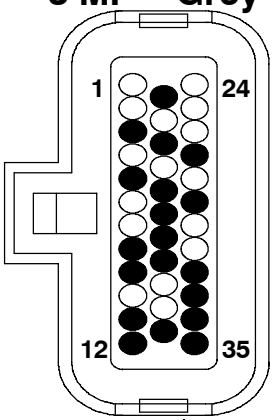
Component	Terminal
REMSN1	3 (14)
REMSN2	4 (14)
CDP	5 (16) (30)
CSP	6 (17) (30)
ENCT	7 (18)
CDT	9 (20)
DTT2	10 (21)
AAT	11 (22)
RAT	12 (23)
REMSN1 (SP23)	14 (3)
REMSN2 (SP23)	14 (4)
REMSN3	15 (33)
CDP	16 (5) (30)
CSP	17 (6) (30)
ENCT	18 (7)
CDT	20 (9)
DTT2 (SP11)	21 (10)
AAT	22 (11)
SAT (SP12)	23 (35)
RAT (SP12)	23 (12)
FLS	26
CDP (SPK4)	30 (5) (16)
CSP (SPK4)	30 (6) (17)
REMSN3	33 (15)
EV1	34
SAT	35 (23)

2 MP - Black



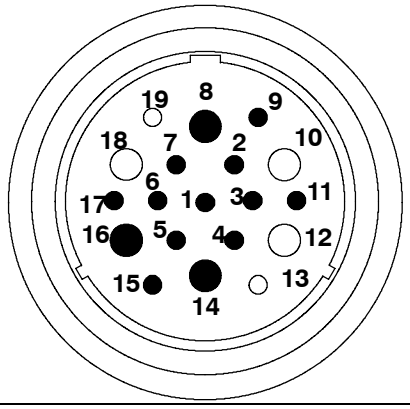
Component	Terminal
REMS1	3
DAS	6
CSMV-D	8 (19) (20) (32)
REMS2	13
ENCLS	15
DS	16
ENOPS	17
ENSCU	18
CSMV-C	19 (8) (20) (32)
CSMV -A	20 (8) (19) (32)
HC9	25
ENOLS	28
HPS	29
CSMV-B	32 (8) (19) (20)

3 MP - Grey



Component	Terminal
SATCOM (C)	3
SLP (C)	5
ORL	8
CL	9
SV2	11
UL1 (Front)	12
SLP (E)	13
SATCOM (B)	15
SLP (A)	17
FHR (HC-17)	18
FL	19
DL	20
UL2 (Rear)	23
SATCOM (A)	27
SLP (B)	29
HL	33
SV4	34
SV1	35

HC Plug For All Units



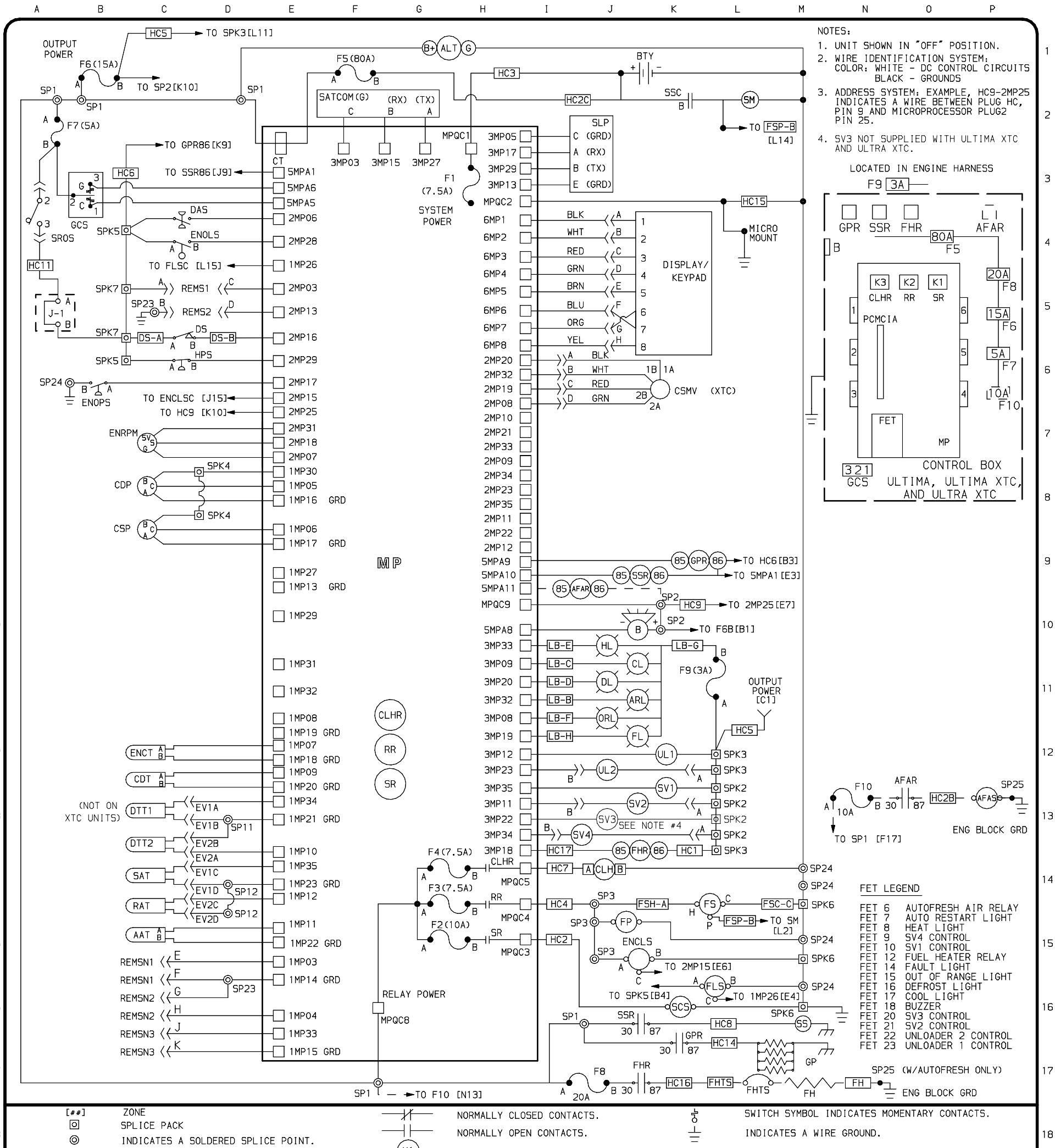
Component	Terminal
+12vdc Input from SPK3 to Fuel Heater Relay Coil	1
+12vdc Output from (MPQC3) to ENSCU-16	2
+12vdc Output from transformer to starter motor (SM)	2C
+12vdc Input unswitched Power from Battery (BTY+) To Main Power In (MPQCI)	3
+12vdc Output from (MPQC4) to SPK20	4
+12vdc Output unswitched to – SPK2 SPK3	5
+12vdc Output from J1 jumper to – SPK5 SPK7	6
+12vdc Output from Clutch Relay to Clutch (CLH)	7
+12vdc Output to Starter Solenoid (SS)	8
+12vcd Output to 2MP25	9
+12vdc from SROS to J1 jumper *	11*
+12vdc Output to Glow Plugs (GP)	14
-12vdc Input Ground from Battery (GRD)	15
+12vdc Output to Fuel Heater Circuit (FHTS)	16
-12vdc Output to Fuel Heater Relay Coil (FHR)	17
Unused Teminals: 10, 12, 13, 18 & 19	
NOTE: Terminal 11 used only with units with J-1 Jumper	

ADVANCE MICRO DISPLAY HARNESS CONNECTIONS

Test Point	Pin	Color	Description
TP14	Pin 1	Black	+12 Vdc for Display backlighting and indicator LED□s
TP13	Pin 2	White	Ground for Backlighting and indicator LEDs
TP13	Pin 3	Red	Ground for Backlighting and indicator LEDs
TP12	Pin 4	Green	+5 Vdc for Display processor and LCD
TP11	Pin 5	Brown	Display ground
TP10	Pin 6	Orange	TX the serial communications from the control to the display
TP9	Pin 7	Blue	RX the serial communications from the display to the control
TP8	Pin 8	Yellow	Display ground

VOLTAGE TESTS:

Negative Test Lead	Positive Test Lead	Voltage Reading
TP13	TP14	12
TP13	TP12	5
TP13	TP11	0
TP13	TP8	0
TP11	TP14	12
TP11	TP8	0
TP8	TP14	12



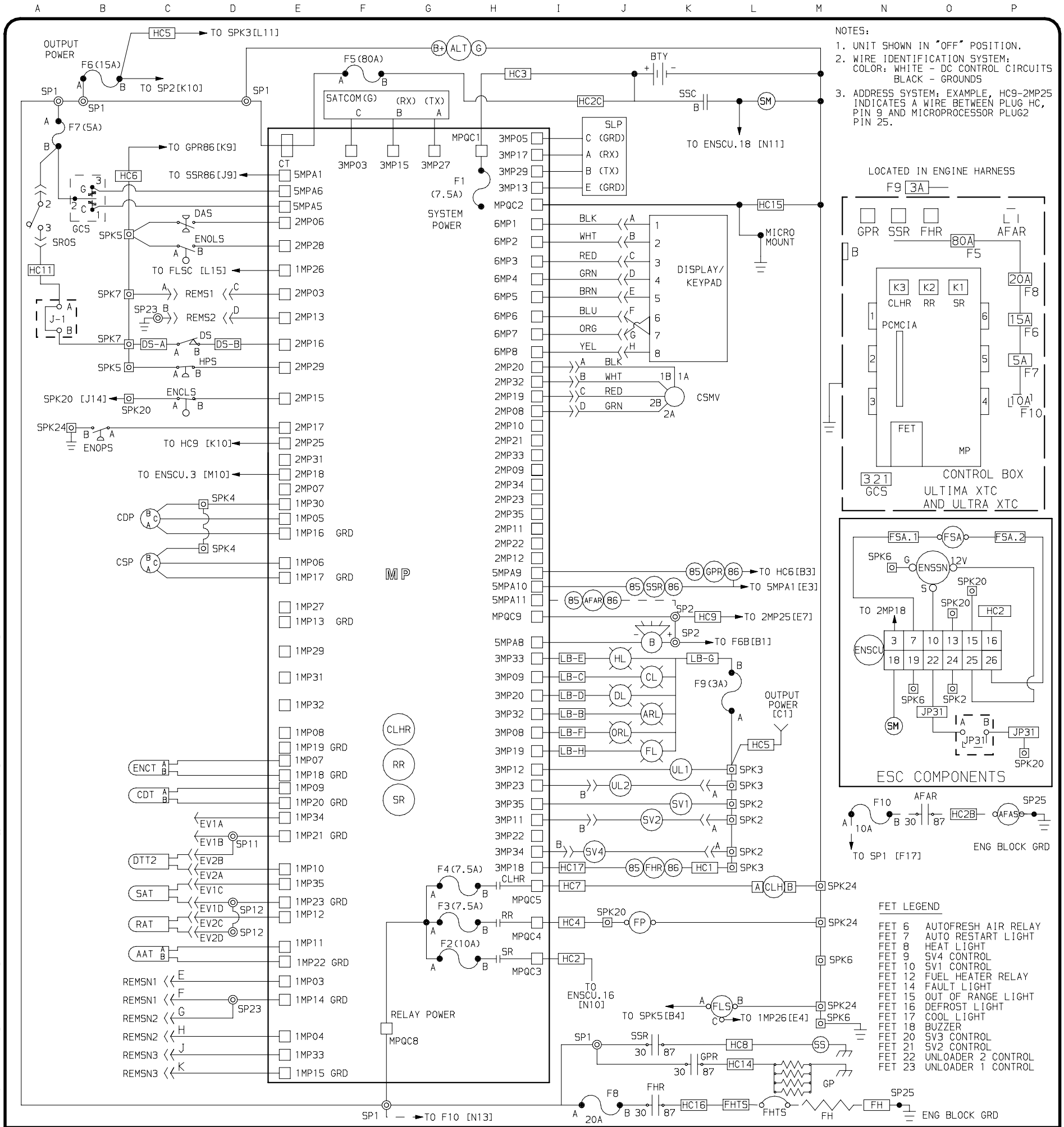
[##] ZONE
SPLICE PACK
INDICATES A SOLDERED SPLICE POINT.
T1 PIN CONNECTION
1 COMPONENT CONNECTION NUMBER OR LETTER

NORMALLY CLOSED CONTACTS.
NORMALLY OPEN CONTACTS.
X1 INDICATES CONNECTION
HC1 OR MULTIPLE PLUG CONNECTION NUMBER

SWITCH SYMBOL INDICATES MOMENTARY CONTACTS.
INDICATES A WIRE GROUND.
INDICATES A CHASSIS GROUND (NO WIRE).
INDICATES A CONNECTION,WIRE,LUG,ETC.

ZONE	SYMBOL	DESCRIPTION
C15	AAT	AMBIENT AIR TEMPERATURE
I9,O13	AFAR	AUTOFRESH AIR EXCHANGER RELAY (OPTION ON XTC)
O13	AFAS	AUTOFRESH AIR EXCHANGER SOLENOID (OPTION ON XTC)
G1	ALT	ALTERNATOR
J12	ARL	AUTO RESTART LIGHT (LIGHT BAR)
J10	B	BUZZER
K1	BTY	BATTERY
C8	CDP	COMPRESSOR DISCHARGE PRESSURE
C12	CDT	COMPRESSOR DISCHARGE TEMPERATURE
J11	CL	COOL LIGHT (LIGHT BAR)
J14	CLH	CLUTCH
H14	CLHR	CLUTCH RELAY
C8	CSP	COMPRESSOR SUCTION PRESSURE
J6	CSMV	COMPRESSOR SUCTION MODULATION VALVE (XTC)
E2	CT	CURRENT TRANSFORMER
C4	DAS	DEFROST AIR SWITCH
J11	DL	DEFROST LIGHT (LIGHT BAR)
C6	DS	DOOR SWITCH
C13	DTT	DEFROST TERMINATION TEMPERATURE
J15	ENCLS	ENGINE COOLANT LEVEL SWITCH
C12	ENCT	ENGINE COOLANT TEMPERATURE
C4	ENOLS	ENGINE OIL LEVEL SWITCH
B6	ENOPS	ENGINE OIL PRESSURE SWITCH (N.O.)
C7	ENRPM	ENGINE RPM
C13,C14	EV	EVAPORATOR PLUG
H3	F1	FUSE MP (7.5 AMPERE)
G15	F2	FUSE SR (10 AMPERE)
G14	F3	FUSE RR (7.5 AMPERE)
G14	F4	FUSE CLHR (7.5 AMPERE)
F1	F5	FUSE MAXI-FUSE (80 AMPERE)
B1	F6	FUSE SV & UL (15 AMPERE)
A2	F7	FUSE SROS (5 AMPERE)
H17	F8	FUSE FHR (20 AMPERE) (OPTIONAL)
L14	F9	FUSE LB (3 AMPERE)
N13	F10	FUSE AFAR (10 AMPERE, DUAL ELEMENT, SLOW BLOW) (OPTION ON XTC)

ZONE	SYMBOL	DESCRIPTION
L17,M17	FH	FUEL HEATER (OPTIONAL)
J17,K14	FHR	FUEL HEATER RELAY (OPTIONAL)
K17	FHTS	FUEL HEATER TEMP. SWITCH (OPTIONAL)
J12	FL	FAULT LIGHT (LIGHT BAR)
L15	FLS	FUEL LEVEL SWITCH
J14	FP	FUEL PUMP
L14,K14	FS	FUEL SOLENOID
B3	GCS	MANUAL GLOW/CRANK SWITCH
M17	GP	GLOW PLUG
K9,K16	GPR	GLOW PLUG RELAY
C1,E1,H1,J2,B3,L3 K10,L11,L14,J14,I14 I15,L16,J17	HC	HIGH CURRENT PLUG
J11	HL	HEAT LIGHT (LIGHT BAR)
C6	HPS	HIGH PRESSURE CUT-OUT-SWITCH (N.C.)
A5	J-1	J-1 JUMPER
I11,I12,K11	LB	LIGHT BAR
F9	MP	MICROPROCESSOR BOARD
F16,I14,H3,H2	MPQC	MICROPROCESSOR QUICKCONNECT
J12	ORL	OUT OF RANGE LIGHT (LIGHT BAR)
C14	RAT	RETURN AIR TEMPERATURE
C5,C6	REMS	REMOTE SWITCH
C15,C16	REMSN	REMOTE SENSOR
H14	RR	RUN RELAY
C14	SAT	SUPPLY AIR TEMPERATURE
F2,G2	SATCOM	SATELLITE COMMUNICATION
K16	SCS	SPEED CONTROL SOLENOID
J2	SLP	SERIAL PORT
L2	SM	STARTER MOTOR
A2,D2,B6,D9,D10 D11/D15,M14,J11/J16 K10,M15,F17 B3/B6,D8/D10	SP	SPLICE POINT
L11/L13,M14/M16	SPK	SPLICE PACK
H15	SR	SPEED RELAY
B3	SROS	START/RUN/OFF/SWITCH
M16	SS	STARTER SOLENOID
K2	SSC	STARTER SOLENOID CONTACTOR
J10,K16	SSR	STARTER SOLENOID RELAY
J13	SV	SOLENOID VALVE
J12	UL	UNLOADER



[##] ZONE
SPLICE PACK
INDICATES A SOLDERED SPLICE POINT.
T1 PIN CONNECTION
1 COMPONENT CONNECTION NUMBER OR LETTER

NORMALLY CLOSED CONTACTS.
NORMALLY OPEN CONTACTS.
X1 INDICATES CONNECTION
HC1 OR MULTIPLE PLUG CONNECTION NUMBER

SWITCH SYMBOL INDICATES MOMENTARY CONTACTS.
INDICATES A WIRE GROUND.
INDICATES A CHASSIS GROUND (NO WIRE).
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ZONE	SYMBOL	DESCRIPTION
C15	AAT	AMBIENT AIR TEMPERATURE
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O13	AFAS	AUTOFRESH AIR EXCHANGER SOLENOID (OPTION ON XTC)
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C12	CDT	COMPRESSOR DISCHARGE TEMPERATURE
J11	CL	COOL LIGHT (LIGHT BAR)
J14	CLH	CLUTCH
H14	CLHR	CLUTCH RELAY
C8	CSP	COMPRESSOR SUCTION PRESSURE
J6	CSMV	COMPRESSOR SUCTION MODULATION VALVE (XTC)
E2	CT	CURRENT TRANSFORMER
C4	DAS	DEFROST AIR SWITCH
J11	DL	DEFROST LIGHT (LIGHT BAR)
C6	DS	DOOR SWITCH
C13	DTT	DEFROST TERMINATION TEMPERATURE
D6	ENCLS	ENGINE COOLANT LEVEL SWITCH
C12	ENCT	ENGINE COOLANT TEMPERATURE
C4	ENOLS	ENGINE OIL LEVEL SWITCH
B6	ENOPS	ENGINE OIL PRESSURE SWITCH (N.O.)
N10	ENSCU	ENGINE SPEED CONTROL UNIT
N9	ENSSN	ENGINE SPEED SENSOR
C13,C14	EV	EVAPORATOR PLUG
H3	F1	FUSE MP (7.5 AMPERE)
G15	F2	FUSE SR (10 AMPERE)
G14	F3	FUSE RR (7.5 AMPERE)
G14	F4	FUSE CLHR (7.5 AMPERE)
F1	F5	FUSE MAXI-FUSE (80 AMPERE)
B1	F6	FUSE SV & UL (15 AMPERE)
A2	F7	FUSE SROS (5 AMPERE)
H17	F8	FUSE FHR (20 AMPERE) (OPTIONAL)
L14	F9	FUSE LB (3 AMPERE)
N13	F10	FUSE AFAR (10 AMPERE, DUAL ELEMENT, SLOW BLOW) (OPTION ON XTC)

ZONE	SYMBOL	DESCRIPTION
L17,M17	FH	FUEL HEATER (OPTIONAL)
J17,K14	FHR	FUEL HEATER RELAY (OPTIONAL)
K17	FHTS	FUEL HEATER TEMP. SWITCH (OPTIONAL)
J12	FL	FAULT LIGHT (LIGHT BAR)
L15	FLS	FUEL LEVEL SWITCH
J14	FP	FUEL PUMP
N8	FSA	FUEL AND SPEED ACTUATOR
B3	GCS	MANUAL GLOW/CRANK SWITCH (OPTION)
M17	GP	GLOW PLUG
K9,K16	GPR	GLOW PLUG RELAY
C1,E1,H1,J2,B3,L3 K10,L11,L14,J14,I14 I15,L16,J17	HC	HIGH CURRENT PLUG
J11	HL	HEAT LIGHT (LIGHT BAR)
C6	HPS	HIGH PRESSURE CUT-OUT-SWITCH (N.C.)
A5	J-1	J-1 JUMPER
N11	JP31	JP31 JUMPER
I11,I12,K11	LB	LIGHT BAR
F9	MP	MICROPROCESSOR BOARD
F16,I14,H3,H2	MPQC	MICROPROCESSOR QUICKCONNECT
J12	ORL	OUT OF RANGE LIGHT (LIGHT BAR)
C14	RAT	RETURN AIR TEMPERATURE
C5,C6	REMS	REMOTE SWITCH
C15,C16	REMSN	REMOTE SENSOR
H14	RR	RUN RELAY
C14	SAT	SUPPLY AIR TEMPERATURE
F2,G2	SATCOM	SATELLITE COMMUNICATION
J2	SLP	SERIAL PORT
L2	SM	STARTER MOTOR
A2,D2,B6,D9,D10 D11/D15,M14,J11/J16 K10,M15,F17 B3/B6,D8/D10	SP	SPLICE POINT
L11/L13,M14/M16	SPK	SPLICE PACK
H15	SR	SPEED RELAY
B3	SROS	START/RUN/OFF/SWITCH
M16	SS	STARTER SOLENOID
K2	SSC	STARTER SOLENOID CONTACTOR
J10,K16	SSR	STARTER SOLENOID RELAY
J13	SV	SOLENOID VALVE
J12	UL	UNLOADER

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